ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

MARCH 1959

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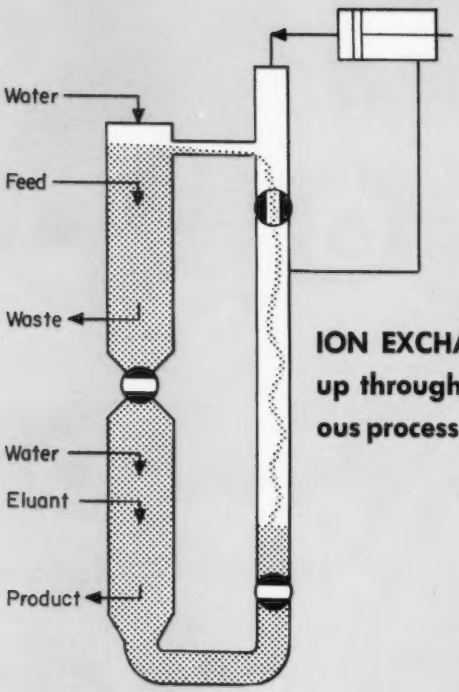
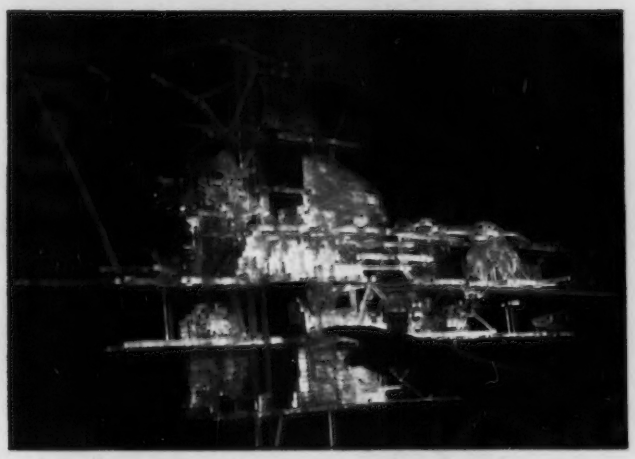


ION EXCHANGERS can step up throughput in a continuous process. . . . . p 80

AN EXPERT cites a new challenge for mining men who work abroad. . . . . p 86



NEVADA'S largest mercury mine maintains production by going deeper. . . . . p 88

Slusher ramp speeds skip loading. . . . . p 91

ALSO IN THIS ISSUE:

E&MJ's survey of mining practice, Part II. . . . . p 93

URANIUM at the crossroad. CMA at Denver. . . . . p 101

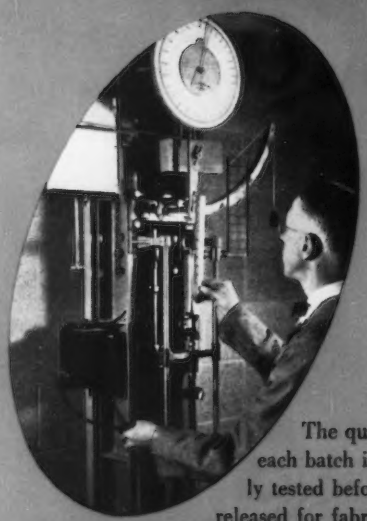
SPONGE IRON via the HyL reduction process. . . . p 92

CONTENTS page . . . . . p 2

A-S-H rubber parts under direct A-S-H quality control

In the compounding of raw materials for every batch of stock, each component is carefully weighed and thoroughly mixed in a rubber mill as per specifications.

Users of A-S-H pumps benefit from having rubber parts made with the up-to-date facilities of the A-S-H plant at Frazer, Pa. The Maximix parts of natural rubber, Neoprene, and other elastomers for abrasive and corrosive service in Hydroseal and Centriseal pumps are compounded, tested and pressure-molded under our control—an added factor toward even greater pumping efficiency.



The quality of each batch is rigidly tested before it is released for fabrication.

In the final process—pressure-molding, modern equipment and expert personnel assure the close tolerance of A-S-H rubber parts.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

SOMETHING NEW UNDER THE GROUND

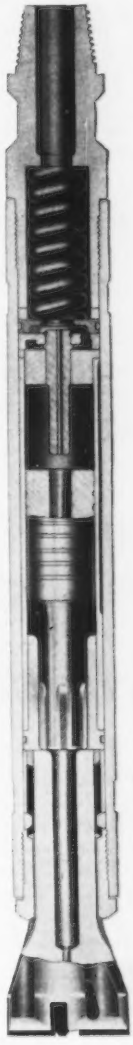
Revolutionary I-R
"DOWNHOLE" DRILL

service-proved on millions of feet of hole,
now available in FOUR SIZES,
with constant, thru-the-bit hole cleaning!

The I-R DOWNHOLE drill is a rugged, heavy-duty, sub-surface percussion drill that delivers full striking power *right at the bit.* Hundreds of units, in operation all over the world, have drilled millions of feet of hole with outstanding records of performance and economy.

Designed for use with Ingersoll-Rand Drillmaster and Quarrymaster drilling rigs, the DOWNHOLE drill is also available to present users of other types of rotary drilling equipment. Conversion from roller cone bits to DOWNHOLE drilling is simply a matter of screwing the drill to the rod or adapter and adding an air-line lubricator.

Here are some of the features that put the DOWNHOLE drill in a class by itself.



PATENTED HOLE CLEANING. All operating air is exhausted through the bit and additional *high-pressure air* blows continuously through the bit for maximum hole cleaning, even while drill is not running.

RENEWABLE WEAR SLEEVE. The entire unit is encased in a renewable wear sleeve that can be replaced at low cost when the outside diameter is worn down. (Patent Pending)

THREADLESS CARSET BIT DESIGN. The service-proved result of years of experimentation and field operation, it has no threads to strip or work loose and no energy loss through a separate connection.

SEALED UNIT. There are no ports in the outside of the drill which could admit abrasive material into the working parts.

CHECK VALVE. An optional check valve can be mounted behind the drill to permit operation under great heads of water—keeps mud and cuttings out of the machine even when the drill is stopped.

SPECIFICATIONS	DHD-275	DHD-325A	DHD-400	DHD-500
BIT SIZES	4¾" & 5"	6" & 6½"	7" & 7½"	9"
ROD SIZES (O.D.)	4"	4" & 5"	5½"	7"
LENGTH (BIT EXTENDED)	52¾"	52½"	63¼"	68½"
OUTSIDE DIAMETER	4¼"	5⅛"	6"	7¼"
WEIGHT (INCLUDING BIT)	158 lb.	236 lb.	362 lb.	586½ lb.

For further details, send for a copy of Bulletin 4203.

Ingersoll-Rand

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11 Broadway, New York 4, N.Y.

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MAXIMIX RUBBER PROTECTED

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

MARCH 1959

VOL. 160 NO. 3

A McGRAW-HILL PUBLICATION

Behind the By-Lines . . . 4
Editorial 79
E&MJ Outlook 17
Man in the News 116
Markets 22
New Products Digest . . 41
Operating Ideas 108
Patents 106
Personals 162
This Month in Mining . 18
Washington Impact . . . 20

Comparing Fixed and Moving Bed Ion Exchange Techniques . . . . C. W. Hancher 80

Trunnion Bearings Profit from Full Lubrication . . . . . E. J. Klovers 84

A Challenging New Dimension in Mining Technology . . . . . E. P. Pfleider 86

Cordero—Nevada's Largest Hg Mine . . . . . J. E. Gilbert & V. P. Haas 88

Slusher Pockets Whip Sticky Ore Problem . . . . . E. L. Fisk 91

HyL Process for Iron Ore Reduction 92

Mining Practice: Part II . . . . . Lloyd E. Antonides 93

CMA's 62nd Annual Meeting 101

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B.F.Goodrich

Men blow up rocks to make room for a dam

B. F. Goodrich improvements in rubber brought extra savings

Problem: Those machines bore deep holes in solid rock with power from compressed air. Dynamite put in the holes will blow the rock to bits. It used to be that the rubber air hose on these machines would go to pieces, too. When heat from the compressor got into the hose, it would harden the rubber, breaking it into loose pieces that clogged the machine, put it out of action.

What was done: B.F.Goodrich engineers went to work on the problem. By adding, subtracting, changing proportions of rubber, they found a special compound for the hose that stands heat without scorching or hardening.

Savings: Hose lined with this new rubber was made and put to work. On jobs where air hose used to go to pieces in weeks, B.F.Goodrich hose now lasts months, even years.

Thousands of feet of B.F.Goodrich air hose are in constant use on the $98,000,000 Priest Rapids Dam project in Washington (pictured above). It's doing dozens of different jobs, and lasting longer doing them, even though it's dragged over rough, jagged rocks, soaked in water, sometimes battered by flying pieces of rock.

Where to buy: Your B.F.Goodrich distributor has complete information on B.F.Goodrich air hose. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B. F. Goodrich Industrial Products Company, Department M-535, Akron 18, Ohio.*

B.F.Goodrich *industrial rubber products*

Behind the By-Lines...

There's only so much space available in the news columns of *E&MJ* each month, and believe us, we spend many an hour deciding what has to go in and what is expendable when the call comes from the layout department to "kill eight columns, no, make it nine!"

There's one brief story that failed to make it last month, and this month, too, and we're kinda sorry. It's not particularly in our line, at least not now.

Seems that the Corps of Engineers has picked up an old gold dredge which, before L208, did work for Northwest Goldfields in Idaho and mined more than $750,000 worth of gold in a two-year period before closure of the gold mines. Now she's been found ideal for excavating a 10,000-ft navigation channel at the Ice Harbor Dam project on the Snake River, handling just plain old dirt. See? One of those stories that could go or not, depending on the space available.

But we were sorry to omit it because of one quote, from a member of the engineers, who noted that, while the dredge had been cleaned up and modernized, her name remains hidden by a coat of rust. She once handled pay dirt, and now just moves plain old mud. "Even a gold-digger", says the engineer, "has a right to shield her past." We're more inclined to the idea that she'd hate to have any of her old friends recognize her now.

Speaking of the problems of publishing the most news in as little space as possible, we're reminded of the famous story concerning the other problem of journalism, getting the most important news.

The classic tale concerns a cub reporter with literary ambitions who was sent to cover the Johnstown flood of May 31, 1889. Totally ignoring the fact that 2,200 lives were lost and a town totally destroyed, the cub went in for purple prose and heavy sobs.

He cabled—"God sits on a high hill tonight and looks down on the city of Johnstown. . . "

His editor interruped the transmission with a cable message of his own. "Forget flood story. Interview God!"

An embattled market price is a tough enough foe for today's mining engineer, without tossing in the handling of extremely tough muck underground. Add the steadily increasing ordinary costs of mining and you've really got a rough proposition.

We visited Cordero Mining Co., the largest mercury mine in Nevada, recently for the story of how one mine is fighting the good fight. (See page 88.) We brought back a story and pictures, but also found that Cordero's toughest problem (outside of the current quicksilver market) was that, with deeper operations came stickier ore and muck.

Our story-within-a-story, on the slusher operation that has whipped the sticky muck problem, gets separate treatment, with a drawing of the slusher, on p 91.

We've asked the experts to chip in a couple of notes on today's mineral processing and one aspect of mill maintenance.

On p 80, you'll find a discussion of fixed-bed and moving-bed ion exchange, with emphasis on the latter, continuous method. We confess that just keeping up with ion exchange is getting more and more difficult, but, as one of our colleagues said a while ago, "When flotation was new, it was pretty scary, too." O.K., men, let's go.

Lubrication of trunnion bearings, while only a part of your mill maintenance problems, can be one of the most important, and certainly the most costly, of all. The author of our article on the problem (page 84) states the case pretty clearly in his last paragraph when he notes that a current solution frees the mill crew from a routine job. But he also notes that failure to perform that routine job can be very expensive. Not, as the fella says, that the job gets done easier, but that it gets done for sure.

One of our functions, as we see it, is to alert *E&MJ's* readers to the important developments in the industry. And, as you've frequently heard us wail, there's rarely enough space and time in which to do it.

Another of our functions, according to some experts in the field of communication, is to tootle our own horn every now and again.

Brace yourself, here it comes. In this issue (page 93) is the second part of "Mining Practice" which began in last month's Survey and Outlook issue. Our Mr. Antonides has spent hours and hours over the past several months, just studying technical periodicals. Add to that time the days spent in travel and visits to mine operations from the Iron Country to the Southwest, from the American West to Ontario and Quebec. Then add days of conversing with the leading technicians and scientists of the U.S. mining industry here in the office and at many symposia. Then sob a small sob for our Mr. A.

There he was, two months ago, with a mountain of notes and papers, all set for the February issue. As you might expect of a man with such a problem, the original number of pages assigned him for February didn't come near his needs. Once turned on, Mr. A. is a hard man to turn off. You've gotten nine pages of mining practice, now here's eight more.—And we believe, with pardonable pride, you'll not find a better compendia of information anywhere else today.

Last month's meeting of the Colorado Mining Association's National Western Mining Conference had, among its highlights, a kindly reference to the U.S. State Department.—And no walls fell down. (Page 101).

On p 86, Prof. Eugene Pfleider of the University of Minnesota's mining school has several points to make on one problem faced abroad by the State Department and the U.S. mining industry alike.

Today's engineers, says Prof. Pfleider, need schooling in more than the sciences if they are to work overseas with any degree of success. The author, who is also a consultant for Freeport Sulphur Co. in Cuba, knows whereof he speaks. Last summer he spent a short sojourn in the hills of Oriente, Cuba as a guest of the partisans of Fidel Castro, and at their polite, but firm request. Pfleider, and the U.S. and Canadian personnel from Freeport's operations who were held, were released prior to the success of the revolt.

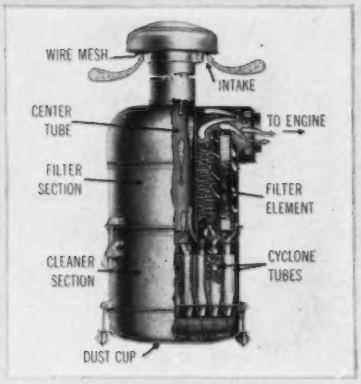
All of which points up our friend's thesis.—That a diplomatic talent is required to do the job well, both in working in a foreign country and making it clear to foreign nationals that any mining program must benefit the miner and the local citizen, his nation and his standard of living.

SPECIAL REPORT TO CATERPILLAR OWNERS:

Parts you can trust. Dependable round-the-clock service

New Caterpillar dry-type air cleaner: CUTS SERVICING TIME 75% AVAILABLE FOR FIELD INSTALLATION on D8, D9, DW20, DW21 and No. 583

AIR-BORNE DUST is the deadly enemy of your engine's vital parts. Now, the new Cat dry-type cleaner gives positive protection against the entrance of harmful dirt—and its simplified servicing requires only about 5 minutes instead of 20 as with the oil-bath type!



THE NEW CATERPILLAR DRY-TYPE AIR CLEANER removes 99.8% of the air-borne dust from the intake air, even under the most severe conditions. Air enters through the stack cap where wire mesh screens out leaves and similar trash. Then the air passes down the center tube and swirls down the cyclone tubes. Centrifugal action throws the dirt against the sides of the tubes. From here 95% of the dirt falls through the funnel section into the dust cup, and the relatively clean air passes on to the resin-impregnated, cellulose filter. This element removes the rest of dirt and allows only clean air to enter the intake manifold. Filter elements can be cleaned and have lasted 3,000 hours without loss of efficiency.

SERVICE COSTS ARE SLASHED! Here is the experience of WEGCO Equipment Rental, Inc. of Cleveland, N. C., as told by the Superintendent of Maintenance, Mr. George R. Bell, "The dry-type cleaner saves us money. We have to clean our air cleaners daily because of dusty conditions. The oil-bath cleaners take about 20 minutes to clean and 5 quarts of oil. That's 60 cents in labor and $1.28 worth of oil, a total of $1.88 per machine. This dry-type cleaner takes only 5 minutes to service—about 15 cents labor. It saves us $1.73 on each machine every day."

SERVICE TIP: To empty dry-type cleaner dust cup, simply loosen wing nuts, remove cup, empty and replace. Occasionally the filter element will need cleaning. Merely remove it, blow off dust or wash in water, then replace.

YOUR CATERPILLAR DEALER has the full story on how much *you* can save by changing to the new and efficient Cat dry-type air cleaner. Remember, he stands behind every part he sells. See him today!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A. **CATERPILLAR**

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One man operated GISMO® Transloader

- . . . with round-trip travel 1,600 feet
- On shorter hauls tonnage ranges up to 2-tons a minute.
- On longer hauls, tonnage ranges down to 1-ton a minute.

This HIGH tonnage production is accomplished by:

One Man
One S-D Gismo Transloader

How can one man and one piece of equipment do so much work? Because the Sanford-Day Gismo Transloader is BOTH a mucking-machine and a truck ALL-IN-ONE!

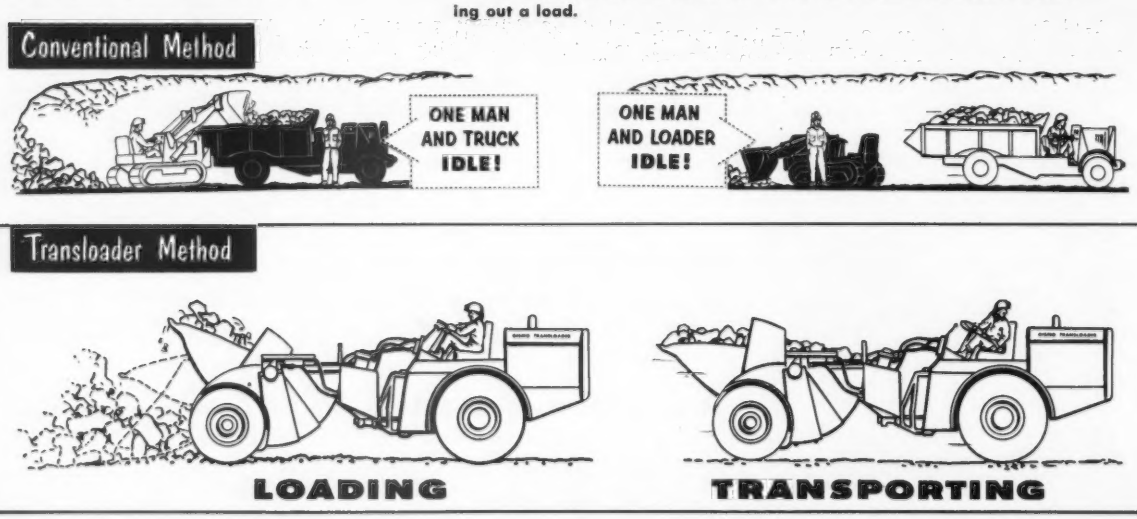
It is a high-speed transport — up to 20-miles per hour either direction! The fact it self-loads enables you to completely eliminate idle time of both men and equipment! Therefore, less capital investment required for additional equipment and manpower to do the job.

In conventional loading of materials, the loader is dependent on auxiliary equipment such as truck or shuttle car, etc. The loader cannot operate without the auxiliary conveyance. Neither does the haulage system operate while being loaded. Thus idling of men and equipment.

Compare this with the S-D Gismo Transloader. When Transloader is operating, man and equipment are working all the time; either mucking or transporting to dumping point! NEITHER THE TRANSLOADER NOR ITS OPERATOR ARE EVER IDLE! They are continuously at work in uninterrupted cycles!

Visualize one or several S-D Gismo Transloaders, each with only one man, MUCKING AND HAULING in your development or production work. Savings are tremendous! Write or call us today. *Manufactured by Sanford-Day Iron Works, Inc., Knoxville, Tenn.*

This photograph catches the action of the S-D Gismo Transloader mucking out a load.



"Mucks-Hauls-Dumps" 100-tons an hour!

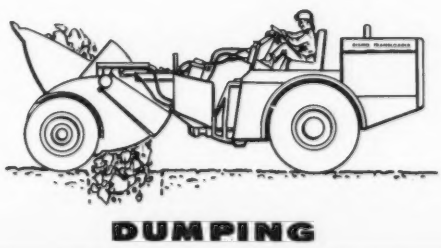
Here you see S-D Gismo Transloader with large, wide dipper down under hard rock. Transloader makes its own roadways and cleans-up completely . . . also moves large boulders for secondary blasting.

. . . and here is dipper raised with full load. This high-powered, high-speed Transloader operates on grades, in favor or against the load . . . negotiates, turns, etc.

This tramming scene (on way to raise) shows S-D Gismo Transloader as truck-transport.

Here load is being dumped into raise. Transloader also backfills waste, or dumps directly into bin . . . or by simple ramps over trucks, cars, conveyors, etc.

THE GISMO TRANSLOADER, rubber-tired Gismo Self-Loading Transport, is an advanced equipment development that is a perfectly natural result of the performance of the Gismo powered by crawler-mounted tractors developed a few years ago and doing an outstanding job in mechanized mining today!



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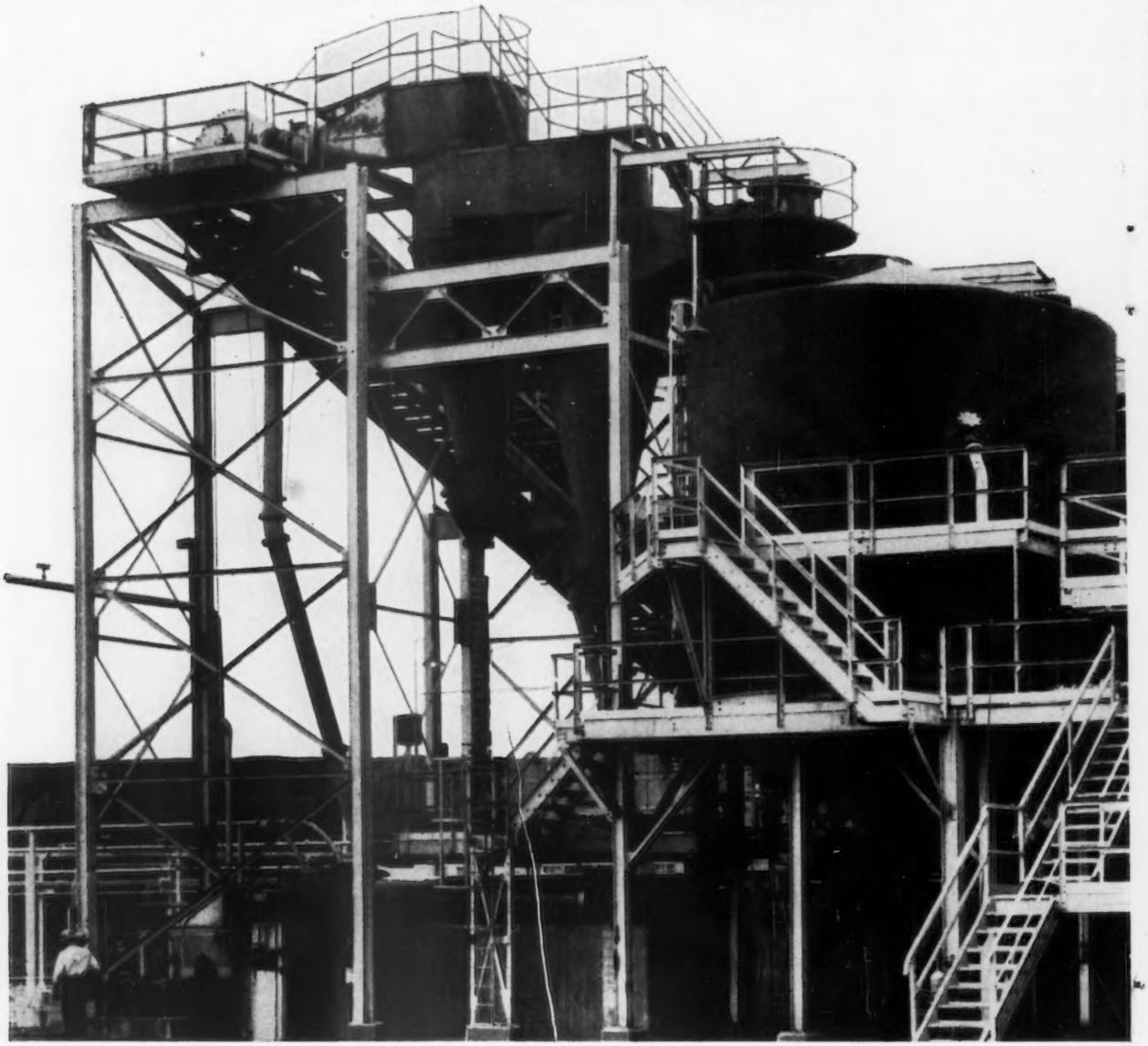
- S-D Mine Cars, all types and kinds.
- Precision S-D Mine Wheels.
- Tough, year-after-year wheel service by special S-D wheel Hard-Facing Process (this can really save you money and eliminate downtime).
- S-D "Brownie" Hoists. • S-D Car Spotters.
- S-D Mine Sheaves and Rollers.
- S-D Slusher-Trains for mining and construction industries.
- S-D Gismo Transloader for mining and construction industries.

More proof of versatility of Fluidization



What is Fluidization?

A valuable new tool for the mining and process industries. When particles are suspended in an upwardly moving stream of gas, the entire dense mass behaves much like a liquid and is said to be fluidized. Applied in the Dorrco fluid bed reactor, fluidization results in a new and more efficient roasting technique, in which each particle of material is individually surrounded by a film of air or gas supplied by an external blower. A combination of reactor, cyclones and other auxiliary equipment forms a complete processing system, adaptable to a wide range of applications.

HELP FOR YOUR PROBLEM: If there's a step in your process where intimate contact between solids and gases is required, fluidization should be investigated. Dorr-Oliver will be glad to work with your research and development men, run pilot plant tests at our laboratories, or cooperate in any other way to insure a realistic evaluation in terms of your particular needs.

Dorrco FluoSolids system produces cobalt, SO_2, and Fe calcine in a single roasting operation!

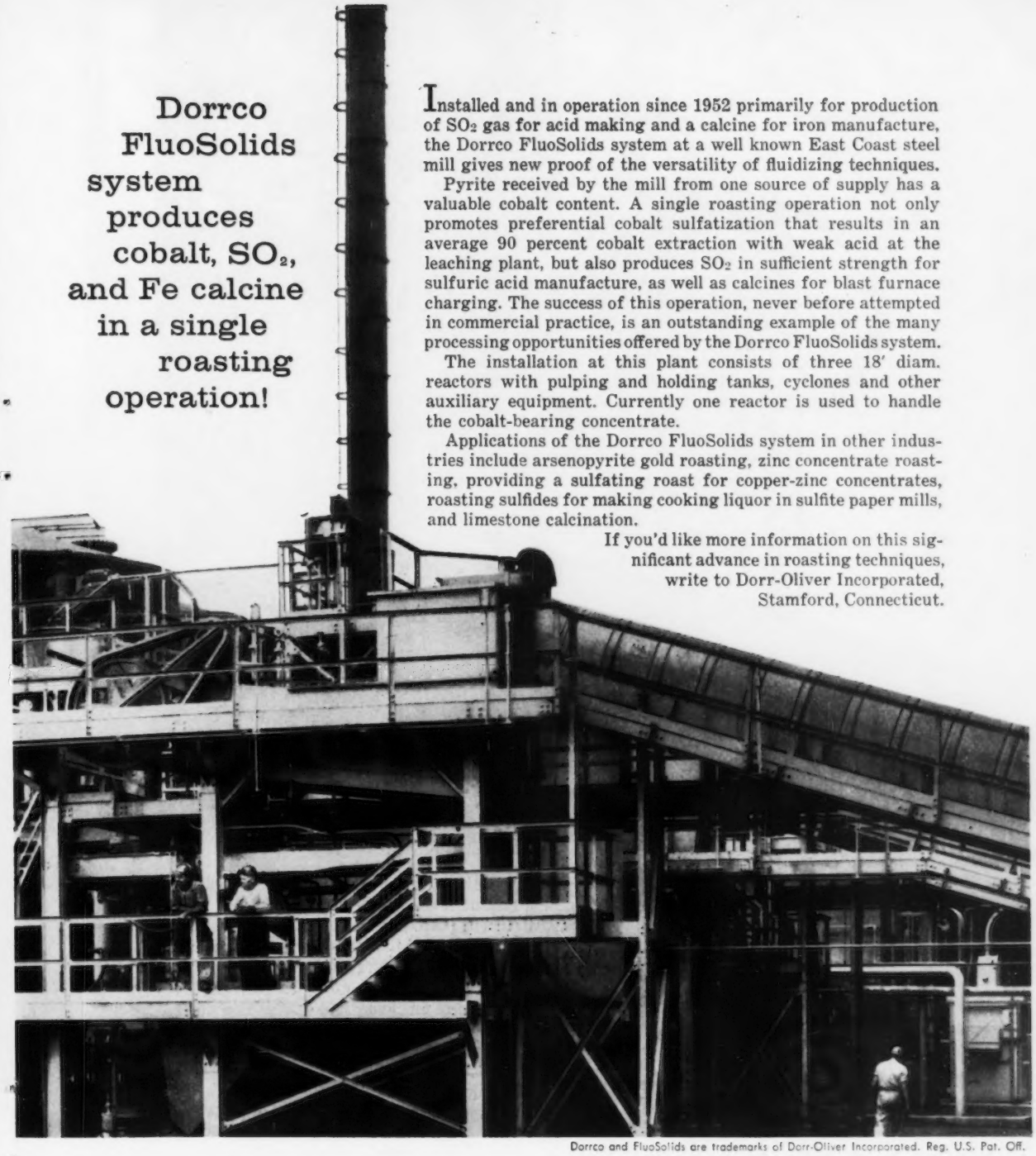
Installed and in operation since 1952 primarily for production of SO_2 gas for acid making and a calcine for iron manufacture, the Dorrco FluoSolids system at a well known East Coast steel mill gives new proof of the versatility of fluidizing techniques.

Pyrite received by the mill from one source of supply has a valuable cobalt content. A single roasting operation not only promotes preferential cobalt sulfatization that results in an average 90 percent cobalt extraction with weak acid at the leaching plant, but also produces SO_2 in sufficient strength for sulfuric acid manufacture, as well as calcines for blast furnace charging. The success of this operation, never before attempted in commercial practice, is an outstanding example of the many processing opportunities offered by the Dorrco FluoSolids system.

The installation at this plant consists of three 18′ diam. reactors with pulping and holding tanks, cyclones and other auxiliary equipment. Currently one reactor is used to handle the cobalt-bearing concentrate.

Applications of the Dorrco FluoSolids system in other industries include arsenopyrite gold roasting, zinc concentrate roasting, providing a sulfating roast for copper-zinc concentrates, roasting sulfides for making cooking liquor in sulfite paper mills, and limestone calcination.

If you'd like more information on this significant advance in roasting techniques, write to Dorr-Oliver Incorporated, Stamford, Connecticut.



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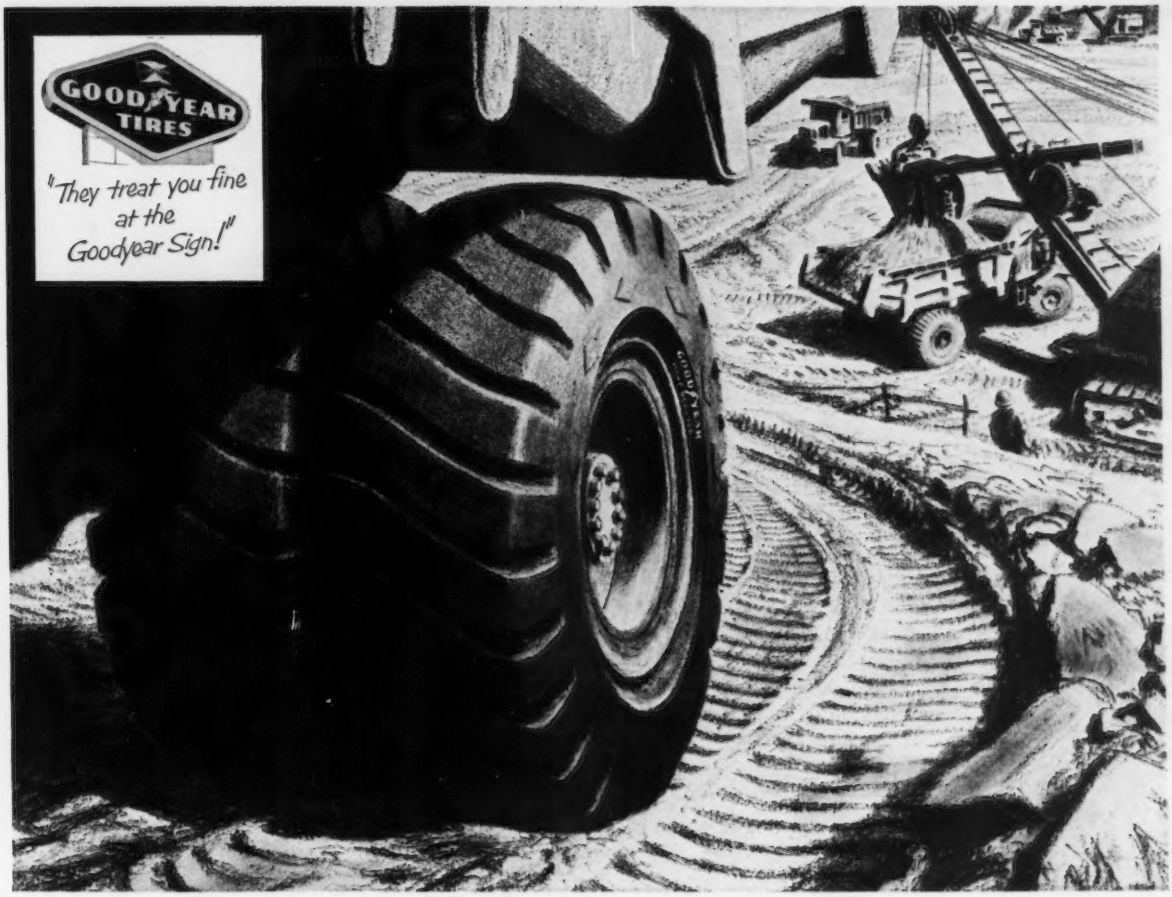
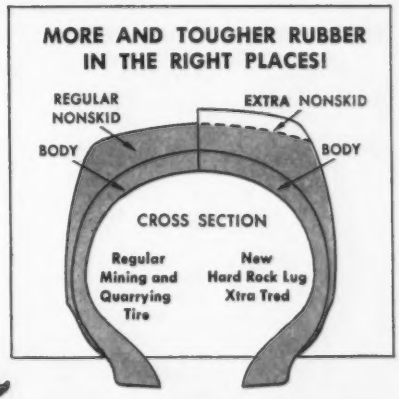


EXTRA TREAD TO TAKE IT WHERE THE GOING'S EXTRA TOUGH!

NEW HARD ROCK LUG XTRA TRED

Specially Engineered Tire for Mine and Quarry Work

More and tougher rubber in the right places—exclusive Triple-Tough 3-T Nylon Cord to back it up. That in a word is why this great new Goodyear tire tops its class. Specifically designed to take the hard knocks, the Hard Rock Lug Xtra Tred—with 18% more tread rubber, reinforced lugs, bonus shoulder heft and huskier sidewalls—stands up under tough punishment that kills lesser tires in short order. And thanks to 3-T Nylon Cord, greatest tire saver in 24 years, cuts, bruise-breaks and blowouts are reduced to an all-time low. Get full details from your Goodyear dealer now. Goodyear, Truck Tire Dept., Akron 16, Ohio.



GOODYEAR

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

...more pick-up with every pass

DOES YOUR JOB REQUIRE A 15 YARD UNIT?

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215

CW-215 SELF-PROPELLED SCRAPER
Capacities: 15 cu. yds. struck, 21 cu. yds. heaped, 42,000 pound rated load

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If it does, don't make a move till you've checked out the self-propelled CW-215 scraper, a 15 yd. struck, 21 yd. heaped unit . . . You can really accelerate the production of your equipment fleet with this 'plus-yardage', medium capacity scraper — which will dovetail right into your present work cycle without upsetting schedules . . . Like all Curtiss-Wright scrapers, you also get a practical combination of unit construction, Roto-Gear steer, constant live winch and positive roll-out ejection. Ask your local Curtiss-Wright distributor to show you a CW scraper in action — he's the man to know if you want to move more dirt at a greater profit to you.

SOUTH BEND DIV. CURTISS-WRIGHT CORPORATION, SOUTH BEND, INDIANA

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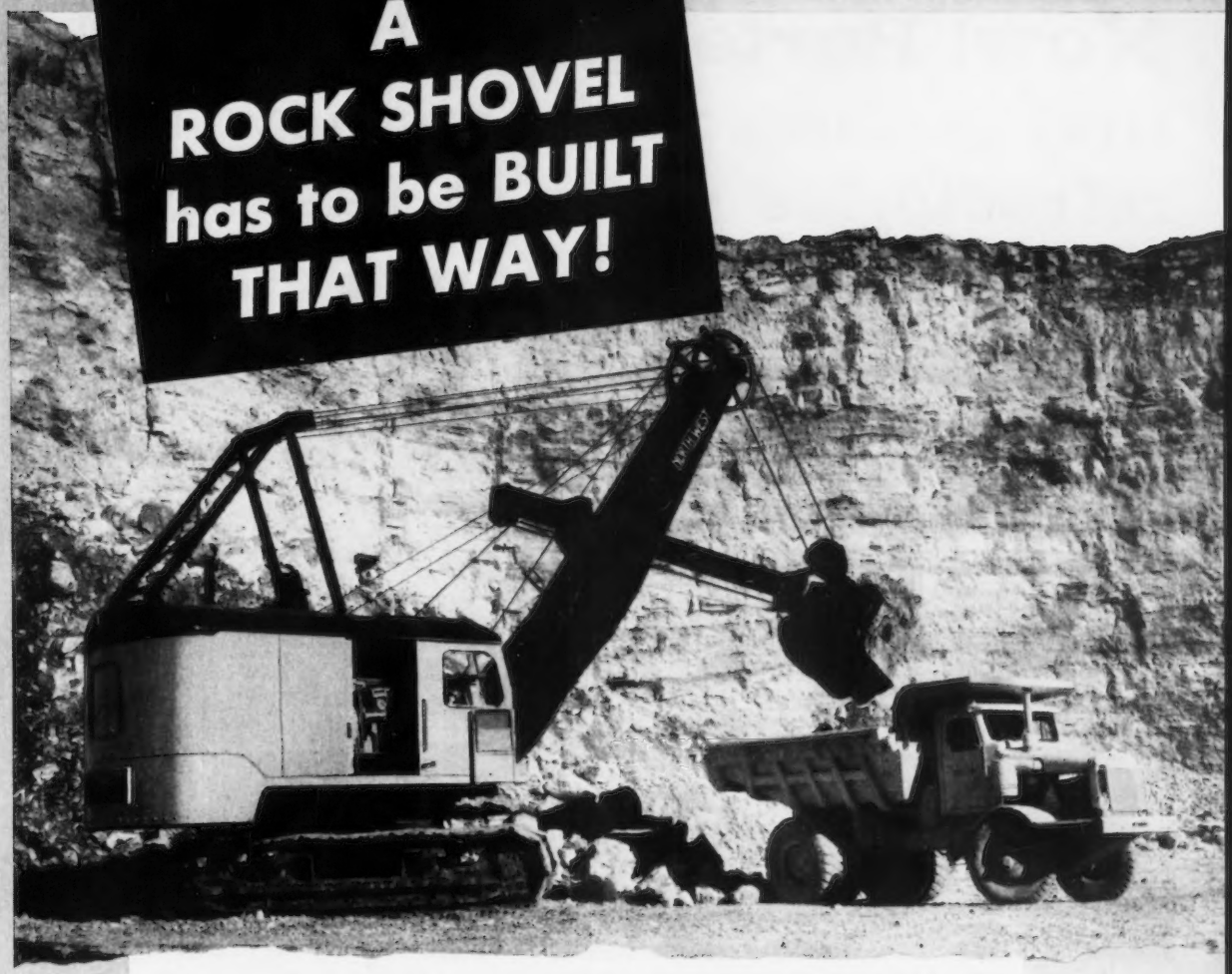
A ROCK SHOVEL has to be BUILT THAT WAY!



The recognized superiority of Northwest Shovel performance in rock didn't just happen. A *real* Rock Shovel has to be built that way. Northwest Shovels were engineered to handle rock digging at its worst and Northwest advantages in rock mean greater output in easy digging.

The qualities that make Northwest outstanding in any type of digging are easy to check. Start with the model you are interested in from the big 80-D 2½ yd. rig down to the workhorse of the ¾ yd. field, the Model 25-D.

Booms, rugged and powerful, Sticks of heavy section, the Northwest Dual Crowd—a Crowd that gives you crowding force most other Independent Crowd Shovels waste! This simple crowd with its additional crowding force makes it possible to handle harder digging and more yards per hour—per day—per month!

Other advantages—the Cushion Clutch eliminates shock overloads before they can reach operating machinery—the Feather-Touch Clutch Control assures ease of operation and gives the "feel-of-the-load" free from the complications of compressors, tubing and other delicate mechanisms, Uniform Pressure Swing Clutches take the jerks and grabs out of swinging and make spotting heavy loads easier—these are just a few of the many features that combine to assure performance in any digging—features that have made Northwest the recognized leader in rock work.

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

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NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

Now! Porter goes basic! The first in the south, this new basic refractories plant at Pascagoula went "on stream" **during February**

Porter's new $12 million Pascagoula Works is a sea-water periclase and basic brick facility using the finest in modern equipment in a fully integrated production unit.

Southern industry will soon begin benefiting from faster deliveries and lower freight rates on all forms of basic refractories from H. K. Porter's new Pascagoula Works on the Gulf Coast. Inland waterways, too, will allow easy access to America's industrial heartland.

Products of this new works—Porter's 15th refractories plant—will include burned, chemically bonded, plated and plain brick, mortars, castables, plastics and ramming mixes of chrome and periclase compositions. A unique double-burning process employed in producing Porter periclase grain insures basic refractory products of the highest quality.

Annual output of this new plant indicates an ample, dependable source of supply. Equally important, Porter engineers and ceramists provide the complete customer service that is rapidly becoming recognized as a Porter principle.

For information on shipments, prices, or *any* refractories problem, write *Pascagoula Works, Refractories Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

PORTER BASIC REFRACTORY PRODUCTS

BASIC REFRACTORY BRICK
(burned and chemically bonded in both metal clad and plain categories)

CM-30	Chrome Magnesite
CM-40	Chrome Magnesite (Roof Brick)
MC-70	Magnesite Chrome
Kilmag	Magnesite Chrome (for rotary kilns, offered in burned and plated only)
M-90	Periclase

BASIC REFRACTORY SPECIALTIES

Kromtite	Chrome Air-Set Mortar
Plastikrom	Plastic Chrome Ore
Kromor	Ground Chrome Ore
Kromform	Chrome Castable
Subhearth Kromform	Chrome Castable
Airkrom-C	Coarse Chrome Gun Mix
Airkrom-F	Fine Chrome Gun Mix
Magnaram 85	Periclase Ramming Mix, 85% MgO
Magnaram 95	Periclase Ramming Mix, 95% MgO
Peritite	Periclase Air-Set Mortar

REFRACTORIES DIVISION PORTER **H.K. PORTER COMPANY, INC.**

DIVISIONS: Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Moulding, National Electric, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Made its Reputation in the **SCHOOL OF HARD KNOCKS!**

Roebling SH-D Portable Power Cable

From its rugged, abrasion and weather-resistant Roeprene® Sheath, right to the heart of its extra-flexible conductors, Roebling SH-D Portable Power Cable was designed to give full-power performance. The extra quality features show you why Roebling SH-D is better in terms of superior service, ease of installation and maintenance. For more facts, write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

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Subsidiary of The Colorado Fuel and Iron Corporation

Extra—Special semi-conducting tape around each super-flexible, stranded conductor to prevent ionization.

Extra—Butyl conductor insulation for outstanding electrical properties, plus heat, moisture and ozone resistance.

Extra—Free-riding, all-rubber fillers for moisture resistance, splicing and terminating ease, unusual flexibility.

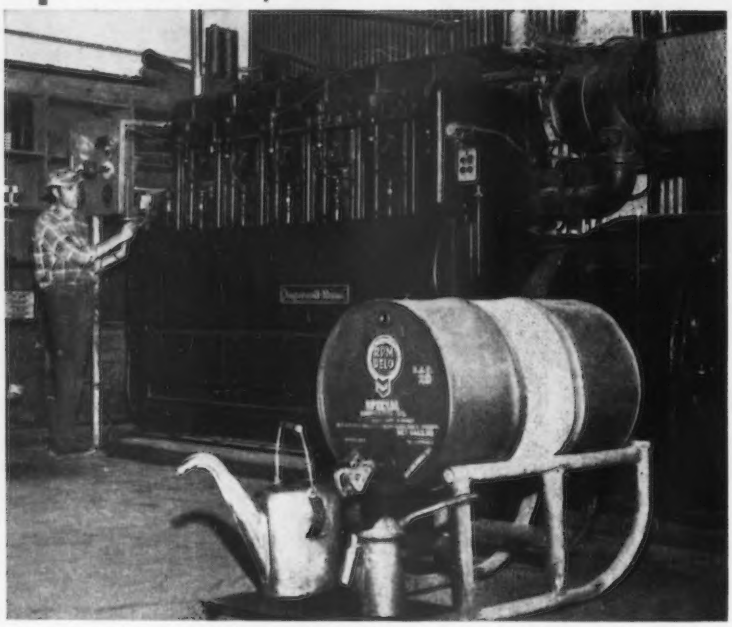
Extra—A combination of properties which permits operation with copper temperatures up to 90° C.

ENGINEER'S FIELD REPORT

PRODUCT **RPM DELO OIL**

FIRM **PORTER BROTHERS CORP.**
Bear Valley, Idaho

Operates 7,000 hours without measurable wear



Lubricated with RPM DELO Oil, this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.

Trucks hauling firm's ore work 'round the clock, 9½ months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.

Giant dredge (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our diesel-generators for power," explains Superintendent Clay La Fon (right). "That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

Why RPM DELO Oils reduce wear—prolong engine life

- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming

For More Information about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.

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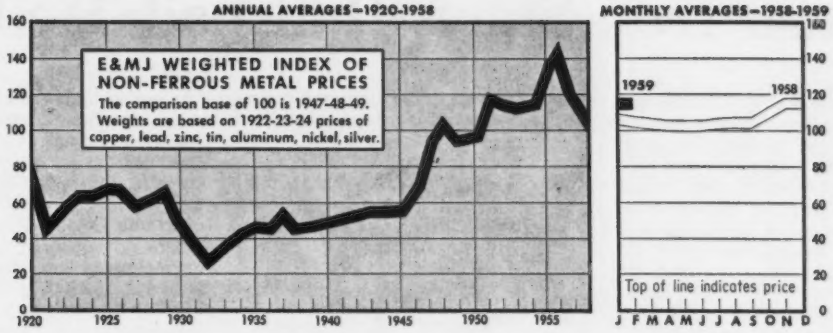
E&MJ OUTLOOK

PRICES



MARKETS

Higher prices for copper offset a decline in lead and nudged *E&MJ*'s metal price index upward from 117.1 for January to 117.6 for February. The *E&MJ* index of weighted non-ferrous metal prices has been recalculated to a base of 1947-49=100, in conformance with the base period used by the Federal Reserve Board Index of Industrial Production, and U.S. Bureau of Labor Statistics.

●

AT HOME

Merger talks indicate a continuing diversification trend in the mining industry. Vanadium Corp. of America is reported to be discussing plans to merge Keokuk Electro-Metals Co. into VCA. Keokuk produces silicon and other alloying materials for the aluminum and steel industries. Cerro de Pasco Corp. and Consolidated Coppermines Corp. announced a special stockholders meeting to be held March 25 to consider proposals under which Cerro would acquire the assets, liabilities and business of Consolidated.

Although auto sales for January and February were about 18% better in 1959 than in 1958, auto producers say that sales for the remaining 10 months will have to be 30% higher than during the comparable 1958 period to reach the hoped-for 5.5-million domestic car output for 1959.

National Gypsum Co. sales were $63-million for 1958—15% above the 1957 total and highest in the company's history. Company chairman, Melvin H. Baker, is optimistic about the construction industry for 1959. He said his previous estimate of 1.2-million housing starts for the year "is definitely a minimum estimate,"—now the total appears to be heading for 1.3-million starts.

Pittsburgh Steel Co. has acquired 78% of the Bennett Mining Co. This acquisition will enable Pittsburgh Steel to supply 40% of its iron ore requirements from its own mines. Previously the company obtained only 23% from its own properties.

Vitro Corp. of America has acquired the 87½% equity interest in Heavy Minerals Co. held by the Crane Co. A minority interest in Heavy Minerals is held by the French chemical group of Pechiney.

●

LABOR

Failure of employment to keep apace with increasing production is causing labor leaders to plug hard for a more-job campaign. See p 21.

●

ABROAD

A Colorado Mining Association speaker outlined imaginative plans for mining virtually limitless resources of manganese nodules by deep-sea mining, p. 101. Now comes a report in the *Wall Street Journal* that Russia has a much larger oceanographic fleet than the U.S. or U.K., and that its research ships are "up to seven times the size of our biggest research ship, the Chain."

Soviet Russia plans to be the world's biggest aluminum producer by 1965 if present targets are realized. Crude aluminum production in 1945 was 107,153 metric tons. Planned production for 1960 is 1,470,117 metric tons, and for 1965, 3,253,857 metric tons. Full story by McGraw-Hill World News will appear in April News section.

THIS MONTH IN MINING

Wabush Iron Starts Railroad Tie-In

THE THIRD major iron ore development in the famed Quebec-Labrador iron ore field was announced in mid-February by Pickands, Mather & Co. and Canadian Javelin Ltd. A statement by Premier Joseph R. Smallwood of Newfoundland noted that the firms had "completed their agreements to develop and mine the Wabush Lake deposit . . . and the Wabush Iron Co. is proceeding forthwith . . . "

First step in the development will be completion of a 42-mile railroad from the Wabush Iron deposits to the Quebec, North Shore & Labrador Railway, which connects Schefferville in the north, to Seven Islands, the ore shipping port. The QNS&L Railway was built to develop Iron Ore Company of Canada's mammoth Knob Lake deposit, and was the first of the railways constructed through the rugged muskeg country.

The second of Quebec-Labrador's major iron ore developments, and another one involving a herculean railroad construction job, is the Quebec Cartier Mining Co. property near Mt. Reed. Quebec Cartier's construction job runs 192 miles north from Port Cartier (near Seven Islands) almost in the same direction as the 360-mile long QNS&LR line to Knob Lake.

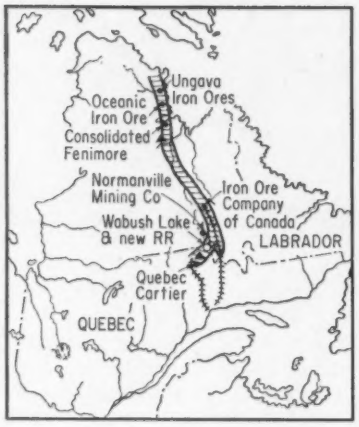
Quebec Cartier is to be the largest of the mines developed so far, with planned capacity of 60,000 tpd of ore, to produce 8-million tons of concentrate per year.

Cartier has already let contracts for construction of a deep water harbor at Port Cartier, on the St. Lawrence, for the townsite at the mine as well as shops, and for fabrication and erection of water control gates for the 60,000 hp power project on the Hart Jaune River. Concentrate production is due in 1961. Twenty Euclids were recently purchased for the railway job; 14 of the 22-tonners from Scotland and six from a Quebec firm. (*E&MJ*, January 1959, p 117.)

Ioco, operating from Knob Lake since 1954, had mined more than 43-million tons by January 1959. Its town of Schefferville is now an established community and the port of Seven Islands, at the St. Lawrence end of the railway, one of the most modern and efficient facilities of its kind. (*E&MJ*, August 1954, p 125.) Ioco draws its power from the Menihek dam, built as part of the vast iron ore project and supplying the mine and townsite.

In Premier Smallwood's announcement of the Wabush Iron Co. decision, the chief executive of the province noted that the statement by PM&Co. "is of the greatest importance to Newfoundland . . . and in effect guarantees the fastest possible development" of the property. (See p 116)

As a part of the announcement, PM& Co. stated that Wabush, which is also



owned by Steel Company of Canada, Youngstown Sheet & Tube, Interlake Iron and Mather Iron Co., was purchasing the 10% interest which Canadian Javelin held in Wabush Iron and in the Wabush Lake Railway. Wabush leases the property from Javelin, which was founded by John C. Doyle, president and which has invested large sums in the development and promotion of the property. Javelin started the 42-mile railway several years ago. The company, which recently made arrangements to become a U.S. firm, owns other deposits in the area and may use the large payment from its deal with PM&Co. to finance those, and other holdings in the area and in Newfoundland proper. Besides payment to Javelin in immediate cash and royalties and other payments for the part ownership, Wabush Iron has agreed to construct railway facilities to the Javelin holdings in the area and to provide other necessary facilities without capital investment on Javelin's part. Costs would come out of royalty and other payments. Doyle noted that his firm would "press forward on the development of these other areas without delay."

In his announcement, the Premier noted that "Another aspect of the agreement of great importance to Newfoundland is that Wabush Iron and Javelin, who respectively own 51% and 43% of the stock of Newfoundland and Labrador Corp. (Nalco) will now proceed to carry out their commitments to explore and develop the vast 24,000 square miles of territory held by Nalco, which contains important timber and mineral resources."

Still another railroad construction plan has been announced, involving a reported $10-million expenditure to develop iron ore deposits near Seven Islands itself. A new firm, Arnaud Railway Co., will build a 22.7-mile line from a point north of Seven Islands on the QNS&LR.

Areas under examination and development in the Quebec-Labrador area (see map) include Cyrus Eaton's Ungava Iron Ore Co. on Ungava Bay, which is a joint Cleveland-Cliffs, International Iron Ores, Steep Rock and Krupp operation; Oceanic Iron Ore of Canada, a Rio Tinto venture; Consolidated Fenimore Iron Mines, which reportedly has indicated about 1-billion tons of iron-bearing material; Normanville Mining Co., a Jones & Laughlin and Cleveland-Cliffs Company; and the above-mentioned Ioco, Wabush, Javelin and Cartier holdings.

Henry Krumb Bequeaths $6-Million to Columbia

ONE OF THE LARGEST single bequests in the history of Columbia University was announced in mid-February with disclosure that the late Henry Krumb had willed nearly $6-million to the School of Mines. The total bequest may eventually amount to about $10-million.

Mr. Krumb, who died Dec. 27, 1958, left half of his estate to his wife, the former LaVon Duddleson, and the remainder after gifts to individuals and charitable institutions, to Columbia to aid in engineering education. Mr. Krumb when a student, had received scholarship aid.

Mining Calendar

Geological Society of America, Cordilleran Section, annual meeting, University of Arizona, Tucson, April 2-6.

Canadian Institute of Mining and Metallurgy annual meeting. Queen Elizabeth Hotel, Montreal, Apr. 13 to 15.

Wyoming Mining Association, Riverton, Wyo. April 17-18.

Third Symposium on Rock Mechanics, Colorado School of Mines, Golden, Colo., April 20 to 22.

Lead Industries Association, 31st annual meeting, with joint meeting, American Zinc Institute. Drake Hotel, Chicago April 22-23.

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, Pa., April 27, 1959.

American Society of Photogrammetry—American Congress on Surveying and Mapping, Washington, March 8-14.

12th Annual Midwestern Exploration Meeting, El Paso, Tex. April 28-29.

Uranium Section, AIME, Moab, Utah. May 8-10.

35th Annual Conference of Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn. May 21-22.

Open Pit Mining Association, annual meeting, Rolla, Mo. June 18.

Air Pollution Control Association annual meeting, Hotel Statler, Los Angeles, Calif. June 22-26.

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

"Hall of Mining" Opened By Denver Mining Club

A HOUSE-WARMING of the new headquarters of the Denver Mining Club was held in the Mining Exchange Building. It brought out miners and those interested in the gold mining industry to celebrate the opening of the club and to commemorate the 100th Anniversary of the discovery of gold in Colorado. The affair was highlighted by the crowning of the Gold Queen and a program of speakers who lauded the pioneers who put Colorado on the map with their bonanza gold discoveries.

THE GOLD QUEEN is crowned at the new hall by club president Guy V. Emerson. The Queen is Miss Barbara Jorgensen of Denver.

Guy Emerson, president of the Denver Mining Club, crowned the queen and introduced the speakers of the evening. Roy Wicker had started the ball rolling to interest Colorado miners. Numerous programs during 1959 will be arranged and visitors to the club will find exhibits of special interest. As the anniversary year advances there will be a continuous program of events to entertain those from in and out of the state and provide headquarters for Colorado miners and visitors.

Officers of the Denver Mining Club are: president, Guy L. V. Emerson; secretary A. F. Mayham; treasurer E. J. Woodriff.

(Continued on p 114)

As We Went to Press . . .

First commercial production of nuclear-grade beryllium is planned at Imperial Smelting Corp.'s zinc plant at Avonmouth. The major customer will be the U.K. Atomic Energy Authority, which is expected to provide a 100-tpy demand by 1965. The plant is scheduled to go into production by year-end.

Chile's Compania Minera Santa Fe has bought the Laco iron mine, in Antofagasta Province. See "Chile", This Month in Mining.

A joint Dutch-U.S. combine reportedly is investigating the development of 200-million tons of nickel-cobalt ore in the Vogelkop area of northern Dutch New Guinea.

For the first time in the history of the industry, molten sulphur will be pumped from an offshore mine to liquid barges moored at a land base. Ever since Freeport Sulphur planned construction of its Grande Isle mine (*E&MJ*, July 1958, p 18) and during a recent visit by this magazine to the property, the possibility of the pipeline to the Grande Isle plant, seven miles away, has been a subject of discussion.

The challenge of the project was the difficulty of laying a liquid transmission line at Gulf water temperatures which would subsequently have to handle molten sulphur which would enter the line at about 320 deg F. and leave the line at about 280 deg.

The answer appears to be found in a line consisting of three concentric pipes; a 14-in. OD protective casing, a 7⅝-in. OD hot water jacket line, and a 6-in. OD sulphur line. The great expansion expected in the center piping and the outer casing due to the great temperature difference, is apparently to be combated by insulation of the annulus between casing and hot water line and by inclusion, every 16 to 19 in., of ball bearing rollers. A description of preliminary plans will appear in the April issue of *E&MJ*.

Western Nuclear's mill at Rawlins, Wyo. will be expanded from 400 tpd capacity to 850 tpd with contract signing at end-February. The purchase contract for concentrates was extended from Dec. 31, 1962 to Dec. 31, 1966.

This is the first contract of five which were pending before AEC. Allan E. Jones, operations manager at Grand Junction, said other signatures are expected "soon" on contracts for two new mills and two more expansions, for a total of 1,700 tpd additional milling rate in the district. Western Nuclear's was the second of the 1962-1966 limited expansion contracts signed. The first involved Texas-Zinc Minerals' concentrator at Mexican Hat.

Aluminum continues in the news. Current highlights include first publication of Russian figures, (see Outlook, p 17), announcement of plans to double production capacity at Kindrekeso, Yugoslavia to 40,000 tons aluminum and 90,000 tons alumina, and plans for another 10,000-ton aluminum plant in the Salem district of south India (See "India", This Month in Mining.)

WASHINGTON IMPACT

Highlights

A TASTE OF 1960—The heady wine of politics already has Washington a bit giddy in anticipation of next year's all-important Presidential campaign. And the nation's extractive industries are far from immune to its effects.

Mining-state legislators on Capitol Hill are widely credited with a newly influential role in Congress, one which they intend to test thoroughly this session.

Take for example, a recent speech by freshman Sen. Frank E. Moss (D-Utah) at the Western Mining Congress meeting in Denver. "Ours is a minerals and metals economy," said Moss, who replaced veteran Sen. Arthur Watkins (R-Utah) on the Senate Interior Committee. "Chairman Murray and I," Moss announced, "are in agreement that there should be . . . a staff study (of) legislation patterned after the sugar act to assure at all times domestic production of the major minerals and metals."

No one in Washington gives a Sugar Act approach covering a broad range of minerals—including import quotas and price subsidies to protect a share of the U.S. market for domestic producers—much chance of serious consideration in Congress, let alone passage. Sen. Murray has drafted similar legislation for metal-mineral industries before, but never has pushed it.

But Moss' speech does point up how actively representatives of domestic minerals producers in Washington intend to press for new Federal aid this year and next.

FLUORSPAR FIRST—Senate Interior Committee staffers plan to try out the Sugar Act formula on fluorspar. Original plans were to include other commodities, even domestically drilled petroleum, in a package program.

But differences in market shares between foreign and domestic producers, plus other individual characteristics of the problems facing various minerals at home have discouraged lumping all domestically-produced minerals into a blanket piece of legislation.

A STRONGER "BLOC"—It has been pointed out often that mining-state issues cut across ordinary and even traditional party lines, and that last fall's election did not affect domestic producers' strength in Congress from a party standpoint.

But indications of a stronger mining "bloc" in Congress are not hard to find. Majority leader Lyndon Johnson (D-Tex.) favors a shift in balance of political power in Washington from the east to the west and southeast, and is working toward that goal.

As the nation's population center drifts westward, such a shift is helped in the House as well as the Senate, as evidenced by the trend in reapportionment of seats in the lower chamber.

NO DRAMATIC CHANGES—Neither the new strength nor the new activities of mining interests in Washington will produce startling changes in U.S. metal-mineral policy overnight.

But what the "bloc" is doing in effect is to serve notice on the Administration—and for that matter future Administrations, regardless of party—that it will not readily relinquish its voice in setting mining policy.

DEFENSE ESSENTIALITY—The legal basis of so-called "defense-essentiality" on which to peg Government supports is not new to domestic mining industries. It was, in fact, their importance to the national security that was the primary grounds for the bulk of post-war stockpiling and other Federal support programs.

But now the issue of a domestic producer's contribution to the military and defense strength of the U.S. is back in the headlines again, long after it was written off as a basis for stockpiling programs.

The new application of defense-essentiality is in seeking curbs on competing imports. Under a vastly broadened national security section of the Trade Agreements Act (*E&MJ*, February 1959, p 25), the Office of Civil and Defense Mobilization has greater leeway in finding domestic production defense-essential.

Administration Opposes Gold Price Increase

THE EISENHOWER ADMINISTRATION is ready to fight any Congressional drive for raising the price of gold, should one develop on Capitol Hill (*E&MJ*, February 1959, p 24).

Privately, U.S. officials doubt legislation introduced recently by Sen. James Murray (D-Mont.) and several cosponsors reflects a big push on gold prices. For one thing, it applies only to domestic gold which the Treasury is required by law to purchase. It would not directly affect the much larger purchases or sales of foreign gold for purposes of international finance and balance of payments transactions.

But, money managers think any boost in even domestic gold prices would create serious psychological reactions—mostly inflationary—both in the domestic economy and in international financial circles. In fact, economists fear the public reaction much more than any actual effect the price hike might have on the economy here or overseas. The effects predicted by both proponents and opponents of such a move are probably exaggerated, say financial experts.

The real key to the Administration attitude is the fact that Treasury put out a special press release as soon as Murray announced he would introduce his bill — reiterating Treasury Secretary Robert Anderson's support for the present gold price of $35-per-oz at International Monetary Fund and bank's annual meeting in New Delhi last fall. Treasury put out the release because of money scare stories that began appearing in the foreign financial press as soon as Murray announced his bill doubling the price of domestic gold.

Administration finance people admit small domestic gold mines have a rising cost squeeze to deal with. But they say a price hike would help mainly bigger producers, rather than small mines, aside from the obvious disadvantages of risking economic disruptions.

Quota Extension to Cover Processed Pb-Zn Unlikely

ADMINISTRATION trade policymakers are not likely to extend present quotas on imports of unmanufactured lead and zinc to cover any processed forms.

Lead-zinc emergency committee chairman Charles E. Schwab urged such a broadening of present quotas last week at the Western Mining Conference in Denver. Schwab's proposals were the first official industry reaction to reported "evasion" of the quotas by importers who allegedly are bringing in increasing quantities of semi-finished foreign lead and zinc—sheet, oxides, shot and other forms—in order to avoid limits on raw lead and zinc shipments. These semi-finished forms are being reduced

to raw state and sold as such, producers charge.

Trade officials in Washington confirm reports that they have been asked to "do something" about the alleged evasions, but indicate they see no legal means to change the existing White House quotas unless domestic producers request a second Tariff Commission escape clause action, this one aimed at manufactured products as well as unmanufactured metal. Industry spokesmen have asked for quick action on their complaints.

The commission's recommendations adopted by the President last fall covered only unmanufactured lead and zinc. For this reason, Administration officials explain, they see further escape clause action as the first step.

Privately, top trade officials say a broadening of present quotas wouldn't work, even if there were a legal basis for this move. Extension of the quotas to one type of semi-finished product would simply encourage imports of another form, they point out.

One result of the new twist in the domestic producers' running battle against imports may be to hasten and focus more attention on the next United Nations commodity commission lead-zinc conference, now planned for late April. Hopes for international controls and subsequent removal of U.S. import quotas, however, have not been improved by the latest industry complaints against the present program.

Agriculture Plans Crop Barter for Bolivia Tin

AGRICULTURE DEPARTMENT'S anticipated barter deal for 5,000 tons of Bolivian tin in exchange for domestic crop surpluses closely follows Washington's generally optimistic view of future U.S. and world tin markets.

The deal, which may take several weeks to complete in detail, is aimed at giving Bolivia's tin production a much-needed temporary financial shot in the arm, rather than at draining off world surplus to prop up the market.

Bolivia can't use much of the U.S. surplus crops it will get in exchange for its tin, and will sell them to other Latin American countries approved by Agriculture Department's Commodity Credit Corp. for participation on a three-way deal.

The Bolivian tin must be refined to meet U.S. stockpile specifications. Negotiations are now underway to handle the processing through private commercial channels, either at Wah Chang's Texas City smelter or by a European (probably British) firm.

Washington's interest in keeping Bolivian tin production going is based, not only on the over-all policy of increasing Latin-American economic aid, but on the belief that U.S. and world markets for tin will pick up.

Labor This Month

LABOR'S BARGAINING WOES: Union leaders are beginning to fret over 1959's negotiating prospects. Even with the economic upturn after a slow 1958, the labor chiefs are now thinking this year's contracts won't look as good. It's a paradox, since actually they expect to collect higher wage settlements, on the average, than last year. But they don't expect the total paycheck to rise as much. Here's why:

- 1958 pay boosts were lifted almost double by the rise in living costs for those contracts tied to the Government's consumer's price index. In steel, for example, the flat pay raise was 9¢ and the advance in the cost-of-living brought in another 9¢; total 18¢.
- Stability, or at most a slight rise, is predicted for the 1959 living cost picture. This means no gravy from the escalator clauses. Even if the United Steelworkers negotiate a contract that reflects improved times, it can't match the 18¢ total collected by the union members last year through the regular machinery of the old contract.

Too, while business picks up, the automatic wage increases negotiated last year will be coming in—at a lower rate than the labor leaders will be going for in current bargaining. Walter Reuther's United Auto Workers, as an example, will be collecting just 7¢ annually for the next three years. With no big jump in the consumers' price index, the 7¢ may look meager in 1959. And this compares with the UAW's 13¢ advance in 1958—the 7¢ flat wages plus 6¢ due to price rises under their escalator agreements.

ORGANIZING PROSPECTS PERK UP: AFL-CIO organizers, in a recent strategy huddle, took a rosy view about chances for rounding up new union members this year. Their prediction: that the climate is ripest in years for selling unions to the unorganized. Says AFL-CIO organizing director John Livingston, referring to the two years of labor racketeering revelations: "The peak of damage has now passed." The labor leaders figure the 1958 election returns cleared the air.

Top organizing targets will be white collar workers and southern industry. Labor unions are notoriously weak in both areas, with an estimated 14-million white collar and 6-million production workers in the South still unorganized. But seeing the target and hitting it aren't the same thing. Livingston's organizers haven't yet devised the right approach to either goal. They are now trying to find it, agreeing only at this point that their old tactics just won't pay off. They had some discouraging news recently. The AFL-CIO paid a well-known pollster $35,000 to tap the pulse of the South to determine its attitude to unionism, and whether it had changed in recent years. The answer: "No," that a lot more spadework had to be done.

LABOR OUTCAST WANTS PEACE: The International Longshoremen's Association was expelled from the old AFL in 1953 on corruption charges. George Meany, now AFL-CIO president, led the ouster, and spent two years trying to break up the dock union with a rival AFL-CIO waterfront union. Now, the ILA wants to return to the fold—the first of the racket-expelled unions to try. The other outcasts, the Bakers and Teamsters unions, aren't pushing to return. But the ILA has appealed to Meany to let it come back, with a promise that it has reformed. It's unsettled whether the reform is enough to suit the AFL-CIO leadership as yet. But it seems likely to come eventually.

This means hope for other independents, such as the Mine-Mill and Smelter Workers who have talked reaffiliation, informally, with some AFL-CIO groups. So far, there's no sign that this will come about or that the mine union leadership would comply with reaffiliation demands by the AFL-CIO. Mine-Mill's explusion didn't involve racketeering; it was kicked out on grounds of Communist leadership.

UNEMPLOYMENT PLAGUES LABOR: There's increasing concern by Walter Reuther and industrial union associates over the jobless total. It's failing to reduce, even as production and output go back to normal, when the jobless figure was much lower. Unemployment hovering around the 5-million mark means lots of auto workers, steelworkers out of work. Labor leaders will be plugging a more-job campaign hard both in public talks and in Washington.

MARKETS

Copper Prices Up; Further Increases Expected; Lead and Zinc Down

NON-FERROUS METAL PRICES rose slightly in February according to the *E&MJ* revised index of non-ferrous metal prices. The February index is 117.6% of the 1947-'49 average; the January index was 117.1%. This index is identical with the former index—weights are still the same as those originally used—but the comparison base of 100 has been shifted from 1922-'24 to 1947-'49 in order to make the index more readily comparable with other indexes most of which have shifted to the 1947-'49 base.

The considerable increase in copper prices and the slight increase in tin and silver more than offset the drops in lead and zinc prices.

Copper prices rose sharply in the U.S. and elsewhere in February. Chances are good they will rise further in the future. Custom smelters were well sold at the 31c price to which they went late in February. During the last half of February fabricators in the U.S. were pressing smelters, producers and dealers for metal. Producers returned to the 1955 and 1956 policy of allocating metal. Though U.S. fabricators had only one month contracts with producers, they had an "understanding" at least which in many cases called for minimum and maximum amounts per month for a considerable period. Some fabricators were no longer able to get the maximum—yet many wanted even more than the maximum.

The sharp demand increase by fabricators reflected in part the sureness by buyers and sellers that strikes would occur in the U.S. in the summer among the copper supplying firms.

Rising industrial activity in the U.S. is also responsible for the increased demand for copper. Shipments of fabricated products though well above the recession level have been exceptionally low by some measures. This may be indicated by comparing the shipments of copper in products shown by the Copper Association with the Federal Reserve Board's index of industrial production. In 1954 each point on the index "equaled" 824 tons of fabricator copper product shipments (arrived at by dividing the index into the total tonnage; thus for January 1954 we divided the index of 125 into tonnage shipped of 100,805). In 1955 it was 858 tons and in 1956 it averaged 824, the same as for 1954. We used these three years as constituting an approximately "normal" period. For the three months November 1958 through January 1959 the tonnage per point had been 732. During periods when the index has been at about the recent levels copper product shipments have been much higher than recently (this excludes July when there is a seasonal low). This suggests copper product shipments should have been about 15% higher.

The above calculation proves nothing but, along with other evidence, suggests shipments by copper fabricators have lagged and that their demand for metal, and attempt to buy heavily, may not prevent their stocks from dropping this summer or late spring even if there is no strike among copper suppliers.—Inventories of fabricators' customers may also drop. The Federal Reserve Board index for the three months we used, November 1958 through January 1959, does not include much upward bias from accelerated steel production as a hedge against a steel strike.

Strength of copper markets in Europe was more open to question. All prices in Europe were up in February. But the low "premium" for electro copper over the LME spot price indicates there is no exceptional shortage of spot copper. The practical equality of three months copper with prompt on the LME suggests to some observers that firmness is not solely in anticipation of shortage in the late spring and summer arising from strikes or other involuntary interruptions to supply. But such anticipation is certainly a factor. More nearby troubles have been pertinent as well as fairly heavy buying by Red China and other Iron Curtain countries. Some factors contend prohibition of copper exports to Iron Curtain countries from the U.S., instituted in February by the U.S. Department of Commerce, and the accompanying restrictions on exports to other countries, has firmed markets outside the U.S. Anticipation of price rises in the U.S. tended to keep European prices up and probably will continue to buoy prices there until, or after, summer strikes in the U.S. Demand based on consumption in Europe, though not high, has not been down as sharply as in the U.S. a year ago.

Prices are too high in Europe relative to U.S. prices. As long as European prices are not 1½c or more under U.S. prices a shortage in the U.S. is likely to persist. Only Cuban copper which enters duty free and possibly Philippine copper which has a low duty, is likely to enter. With troubles in Africa that may affect copper output and expected strikes in the U.S., higher U.S. prices may be required in order for U.S. consumers to get the copper they need. But higher U.S. prices could push other prices higher by an equal amount. Many analysts foresee a runaway market. Though removal of the U.S. 1.7c import duty would partly remedy this, no one expects this and pressure from U.S. metal mining areas would be exerted against such a move.

The U.S. producer price may rise to 31c or even 32c—it is known that at least one large producer feels 32c is justified by costs. Certainly some smaller producers feel that way.

A strike hit Cerro de Pasco February 18; it produces about 3,750 tpm of copper. Workers voted to accept a 22% pay increase about March 1. Kennecott's Ray mine division in Arizona was struck by smeltermen of the newly organized local of the United Steelworkers. Copper output at the new smelter, which was 5,700 tons of blister in January, has stopped.

Refined copper stocks in the U.S. were unchanged at the end of January and very low according to Copper Institute figures. Stocks outside the U.S. were up 22,000 tons. World refined copper output was down about 12,000 tons but still very high. World deliveries to fabricators, though off from the previous three months very high figures, were fairly high. World mine output was exceptionally high.

Lead was dropped to 11c per lb New York February 24. On February 11 it had dropped ½c to 11½c. On February 20, Friday, a major custom smelter sold heavily on the West Coast at the N.Y. basis less the standard .2c for the area. The basis price was 11c N.Y., down ½c. Other sellers followed the following business day, February 24. No sales were made February 20 at the lower price on the St. Louis basis so that price did not drop until February 24.

The drop had been expected—sales and shipments had dropped and no significant improvement was expected. *E&MJ* current sales data, American Bureau of Metal Statistics and Lead Industry Association data showed the statistical situation was weak. Stocks continued to mount. In February, sales, which are reported to *E&MJ* for each business day, were very low; they had been low in the preceding months. Acceptance of over 10,000 tons of Mexican lead by CCC in barter, and about half as much from Peru, helped little.

Zinc was cut to 11c East St. Louis, down ½c, by a major custom smelter February 25. Other sellers followed. Some were surprised at the drop. Sales reported to *E&MJ* had been very low. American Zinc Institute data for January showed output well above shipments. Several firms had been reported as increasing output, or preparing to increase. Some sellers say present relatively good business in Prime Western and other galvanizing zinc reflects buying of galvanized material as a hedge against a steel strike—they say whether or not there is a strike, sales of the lower grades will drop off. Special High they suggest has been low (January shipments of Special High were 28,422 tons, down from the preceding three months).

The lower prices of zinc and lead will give added incentive for international action at the third UN conference in N.Y. beginning April 27. Also, pressure for higher U.S. tariffs will increase.

Average Prices February *(E&MJ Quotations)*

Copper:
Electrolytic, domestic refinery .. 29.617
Electrolytic, export refinery 28.726
Electrolytic, c.i.f. Cont'l ports .. 29.671

Lead:
Common, New York 11.560
Common, St. Louis 11.383

Silver
Silver, New York, per oz. 90.444
Silver, London, pence per oz. .. 77.206

Zinc:
Prime, Western, East St. Louis . 11.417
Prime, Western, delivered (g) .. 11.917

Tin:
New York Straits 102.729
Gold, per oz., U. S. price....$35.000
Sterling Exchange 280.935
Quicksilver, per flask $218.000
Antimony (E&MJ) (d) 32.590
Antimony, bulk, Laredo.....29.000
Antimony, in cases, Laredo .. 29.500
Platinum, refined, per oz. $57.278
Cadmium (a) 145.000
Cadmium (b) 145.000
Cadmium (c) 145.000
Al, 99½ dom., ingot.....26.800
export, pig.....22.500
Magnesium, ingot 35.250
Nickel (f) 74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotations.
(b) Cadmium average based on the average of the producers' and platers' quotations.
(c) Cadmium average based on platers' quotation.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Gold dealings declined 12% in February. Prices, practically unchanged in Western Europe and Canada, soared to historic highs for coins and 9-year highs for bars in Bombay and Karachi. Small quantities of Soviet gold arrived in London bringing estimated total Russian exports since the start of the year to $20-$25-million. American purchases of bars and certificates in Canada, London and Zurich continued. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Jan. 31	Feb. 28	Jan. 31	Feb. 28
NEW YORK transit	.....	.....	$35.08⅛	$35.08⅛
MANILA	$42.50	$42.00	36.15	36.10
HONG KONG	46.65	46.60	38.75	38.75
BOMBAY	61.50	65.40	59.50	63.25
TANGIER	40.20	40.60	35.20	35.25
BEIRUT	41.25	41.60	35.21	35.19
PARIS	39.95	40.00	35.35	35.60
BUENOS AIRES	38.50	38.25	36.45	35.90

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of February reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅜c; ¼c deducted for selling common.

Delivered Consumers' plant 29.875 lb
F.o.b. refinery ..... 29.475 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Feb. 1959	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99½% U. S. Dest.	Straits Tin New York
2	29.075	29.025	12.000	11.800	12.000	11.500	24.700	100.875
3	29.600	28.600	12.000	11.800	12.000	11.500	24.700	101.125
4	29.600	28.850	12.000	11.800	12.000	11.500	24.700	101.500
5	29.600	28.325	12.000	11.800	12.000	11.500	24.700	102.000
6	29.600	28.300	12.000	11.800	12.000	11.500	24.700	102.000
9	29.600	28.325	12.000	11.800	12.000	11.500	24.700	102.250
10	29.600	28.150	12.000	11.800	12.000	11.500	24.700	102.125
11	29.600	28.225	11.500	11.300	12.000	11.500	24.700	102.000
12	Holiday	28.375	Holiday					
13	29.600	28.625	11.500	11.300	12.000	11.500	24.700	102.000
16	29.700	28.800	11.500	11.300	12.000	11.500	24.700	102.500
17	29.700	28.750	11.500	11.300	12.000	11.500	24.700	102.625
18	29.650	28.800	11.500	11.300	12.000	11.500	24.700	102.750
19	29.700	28.700	11.500	11.300	12.000	11.500	24.700	103.250
20	29.700	28.850	11.046	11.300	12.000	11.500	24.700	103.625
23	Holiday	28.825	Holiday					
24	29.725	29.175	11.000	10.800	12.000	11.500	24.700	104.000
25	29.675	29.300	11.000	10.800	11.500	11.000	24.700	104.750
26	29.700	29.200	11.000	10.800	11.500	11.000	24.700	104.875
27	29.675	29.325	11.000	10.800	11.500	11.000	24.700	104.875
AVERAGES FOR MONTH								
Feb.	29.617	29.726	11.560	11.383	11.917	11.417	24.700	102.729
AVERAGES FOR WEEK								
Feb.								
4	29.160	28.975	12.000	11.800	12.000	11.500	24.700	100.925
11	29.600	28.265	11.900	11.700	12.000	11.500	24.700	102.075
18	29.663	28.670	11.500	11.300	12.000	11.500	24.700	102.469
25	29.700	28.970	11.143	10.943	11.875	11.375	24.700	103.906
CALENDAR WEEK AVERAGES								
Feb.								
6	29.495	28.620	12.000	11.800	12.000	11.500	24.700	101.500
13	29.600	28.340	11.750	11.550	12.000	11.500	24.700	102.094
20	29.690	28.780	11.415	11.215	12.000	11.500	24.700	102.950
27	29.694	29.165	11.000	10.800	11.625	11.125	24.700	104.625

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Feb. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
2	90.375	76.625d.	281.0000	249s. 6¼d.	$35.00
3	90.375	76.625d.	281.0000	249s. 5½d.	35.00
4	90.375	76.625d.	280.9375	249s. 6½d.	35.00
5	90.375	76.625d.	281.0312	249s. 6¾d.	35.00
6	90.375	76.625d.	281.0000	249s. 5¾d.	35.00
9	90.375	76.875d.	280.9375	249s. 7d.	35.00
10	90.375	76.875d.	280.8125	249s. 7½d.	35.00
11	90.375	76.875d.	280.8125	249s. 8¼d.	35.00
12	Holiday	76.875d.	Holiday	249s. 7¼d.	Holiday
13	90.375	77.125d.	280.8750	249s. 7¼d.	35.00
16	90.375	77.125d.	280.7812	249s. 8d.	35.00
17	90.375	77.125d.	280.8125	249s. 8¼d.	35.00
18	90.375	77.125d.	280.8750	249s. 8d.	35.00
19	90.375	77.500d.	280.9062	249s. 7¾d.	35.00
20	90.375	77.500d.	281.0000	249s. 7d.	35.00
23	Holiday	78.000d.	Holiday	249s. 6d.	Holiday
24	90.625	78.000d.	281.0000	249s. 6¼d.	35.00
25	90.625	78.000d.	281.0000	249s. 6½d.	35.00
26	90.625	78.000d.	281.0600	249s. 6½d.	35.00
27	90.875	78.000d.	280.9800	249s. 6d.	35.00
AVERAGES FOR MONTH					
Feb.	90.444	77.206d.	280.935	—	35.00
AVERAGES FOR WEEK					
Feb.					
4	90.375	—	280.941	—	35.00
11	90.375	—	280.919	—	35.00
18	90.375	—	280.836	—	35.00
25	90.500	—	280.977	—	35.00

Calendar Week Averages: New York Silver: Feb. 6, 90.375; 13, 90.375; 20, 90.375; 27, 90.688.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Feb.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
2	237	238	233	233½	70¾	71	71¼	71½	72⅛	72½	71¼	71½	766½	767	766	766½
3	236¾	237	233½	233¾	70⅝	70½	70⅞	71	71⅝	72	70¾	71	767½	768	767	767½
4	235	235¼	232¼	232½	70⅝	70⅝	71⅛	71¼	72⅛	72⅛	71	71¼	768	768½	768½	769
5	231	231¼	230	230¼	70⅛	70¼	70⅝	70⅞	71⅝	72⅛	70½	71	770½	771	771	772
6	232½	233	232	232½	70⅝	70⅝	71⅛	71⅜	72¼	72⅞	71½	71⅝	771	771½	771½	772½
9	232	232¼	232¼	232½	70½	70⅝	71⅛	71¼	73	73¼	71⅝	71⅞	773	773½	773	773½
10	230½	230¾	230½	230¾	69¾	70	70⅜	70½	72	72½	70⅝	70¾	771½	772	771½	772
11	232¼	232½	232½	232¾	69⅝	69¾	70⅜	70½	73¼	73⅝	71⅛	71⅜	769½	770	769	769½
12	234¼	234½	234½	234¾	69⅞	70	70½	70⅝	73	73½	71⅜	71½	768	768½	768½	769
13	236¾	237	236¼	236¾	69½	69⅝	70⅜	70½	73	73¼	71⅜	71½	768½	769	769	769½
16	237¾	238	237¾	238	69¾	70	70⅝	70¾	73½	74	72	72¼	770½	771	771½	772
17	236¾	237	236¾	237	69¾	70	70¾	71	74¼	74⅝	72⅝	72½	771	772	772	773
18	235¾	236	235¾	236	69½	69⅝	70½	70⅝	74¼	74⅝	72	72½	771½	772	772½	773
19	237¼	237½	237	237⅛	70	70¼	71⅛	71¼	74⅝	74⅞	72½	73	772	772½	774	774½
20	236¾	237	236¾	237	69⅞	70	71	71⅛	74⅝	74⅞	72½	72¾	774½	775	776	777
23	238¼	238½	238¼	238½	70	70¼	70	71¼	75⅛	75½	73¼	73½	771½	772	774	775
24	239½	239¾	239¼	239½	69¼	69½	70¼	70⅝	74⅜	74⅞	72⅞	73	773½	774	775½	776
25	240½	241	240¼	240½	69½	69⅝	70⅛	70¾	75⅛	75¼	73⅛	73¼	781	781½	783	783½
26	240¼	240⅝	239¾	240	69	69¼	70¼	70½	74½	74⅝	72¼	72½	783½	784	785	785½
27	240	240½	239½	239⅝	69	69½	70¾	71	75⅛	75½	73½	73¾	781½	782	784	785
Av'g's	£236.206		£235.531		£69.966		£70.775		£73.681		£71.981		£772.488		£773.450	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated. tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

Feb. 28, 1959

Aluminum ingot, 99 plus % lb.			26.8¢
Antimony, spot, lb., less than carload, in cases			32.59¢
In bulk, carload lots, f.o.b. Laredo			29.00¢
Imported, 10 ton min. (p), 99½%			24¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.45
Calcium, lb., ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb., contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$1.75
Germanium, per gram, 10,000 gram lots			(c)37¢ — (d)40.2¢
Indium, troy oz.	$1.25	@	$2.25
Lithium, lb., 98%	$9.00	@	$11.00
Nickel, cathodes, lb. (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.			74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16			35½¢
Palladium, troy oz.	$16.00	@	$18.00
Platinum (wholesale lots), troy oz.	$67	@	$75
Quicksilver flask of 76 lb. 25 flasks or more	$218	@	$223
Selenium, 99 plus %, lb.—(Feb. 19, 1958)			$7.00
Silicon, minimum 97%, carloads, lb.			21½¢
Semi Conductor grade, lb.			$350
Tellurium, lb.			$1.65
Thallium, 100 lb. or more lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62	@	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	(a)$28	@	(a)$32
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$19	@	$20
48% Cr_2O_3 3 to 1 ratio	$40	@	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi, non bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$127.32
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra, $.915 @ $.965. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines			$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.10	@	$1.15
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra			$10.75–11.25
U. S. scheelite, f.o.b. mill	$19	@	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$64

(a) Nominal. (e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.33	@	$1.36
Copper Sulphate, 100 lb. eff. Oct. 24, '58			$11.90
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46	@	$1.47
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)			28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12¼¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50	@	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)			14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovanadium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7			$102.50

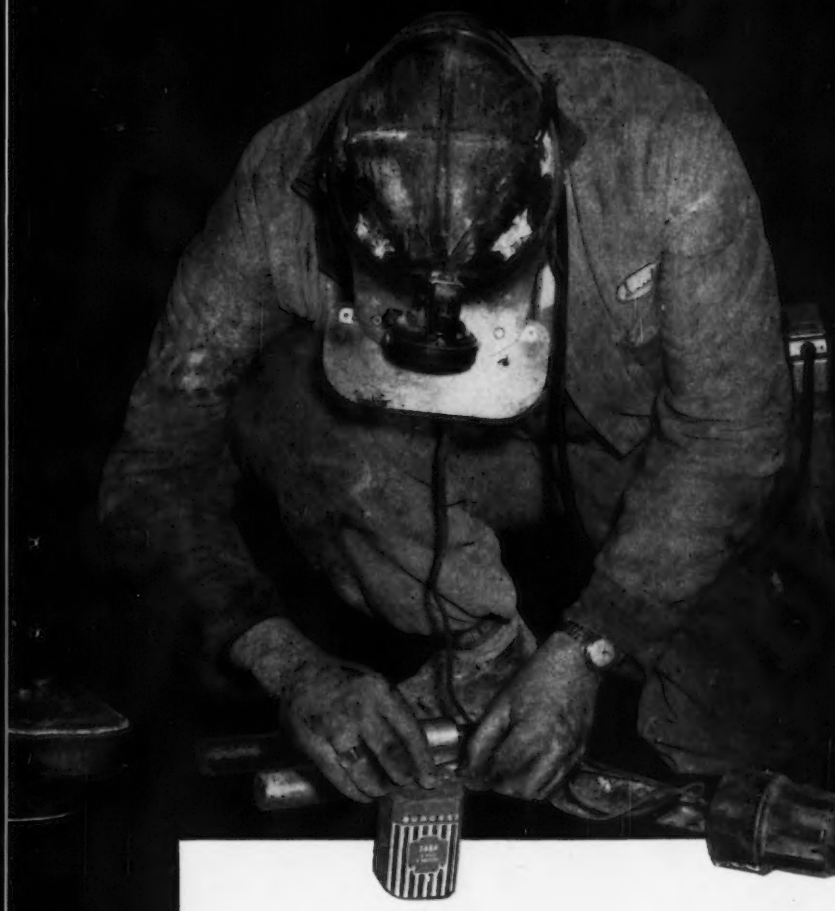
NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400	@	$1,810
Crude No. 2	$750	@	$1,155
Spinning fibers	$370	@	$600
Shingle fibers	$180	@	$220
Paper stock	$120	@	$145
Waste	$75	@	$86
Shorts	$40	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	$220	@	$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$370	@	$428
Shingle stock	$181	@	$200
Paper stock	$120	@	$152
Waste, stucco or plaster			$86
Refuse or Shorts	$41	@	$75
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	@	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.50
Glass feldspar, white, 20 mesh	$10	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)			$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $30 @ $55 per ton. Scrap, $20 @ $30.			
Ocher, Georgia, ton in sacks	$26.50	@	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright			$23.50
dark			$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30	@	$5.50



He wastes no time!

He pinpoints faults with an O-B Locator!

When a fault hits his trailing cable, he wastes no time. He pulls the plug and goes for his O-B Cable Fault Locator.

It takes him only a minute to clip two leads to the power conductors, two to the small six-volt battery—and he's ready for testing. Testing is simple too—a slow walk back along the cable with earphones and slim transistor receiver. When he hears a change in signal he's found the short or open and can make repairs.

If you've been wasting too much time tracking down hidden faults, you could use an O-B Locator, too. It's pocket size, weighs only four pounds, costs less than any cable you'll use it on. Send for Booklet K-423 for complete information.

Ohio-Brass

MANSFIELD (B) OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

product:

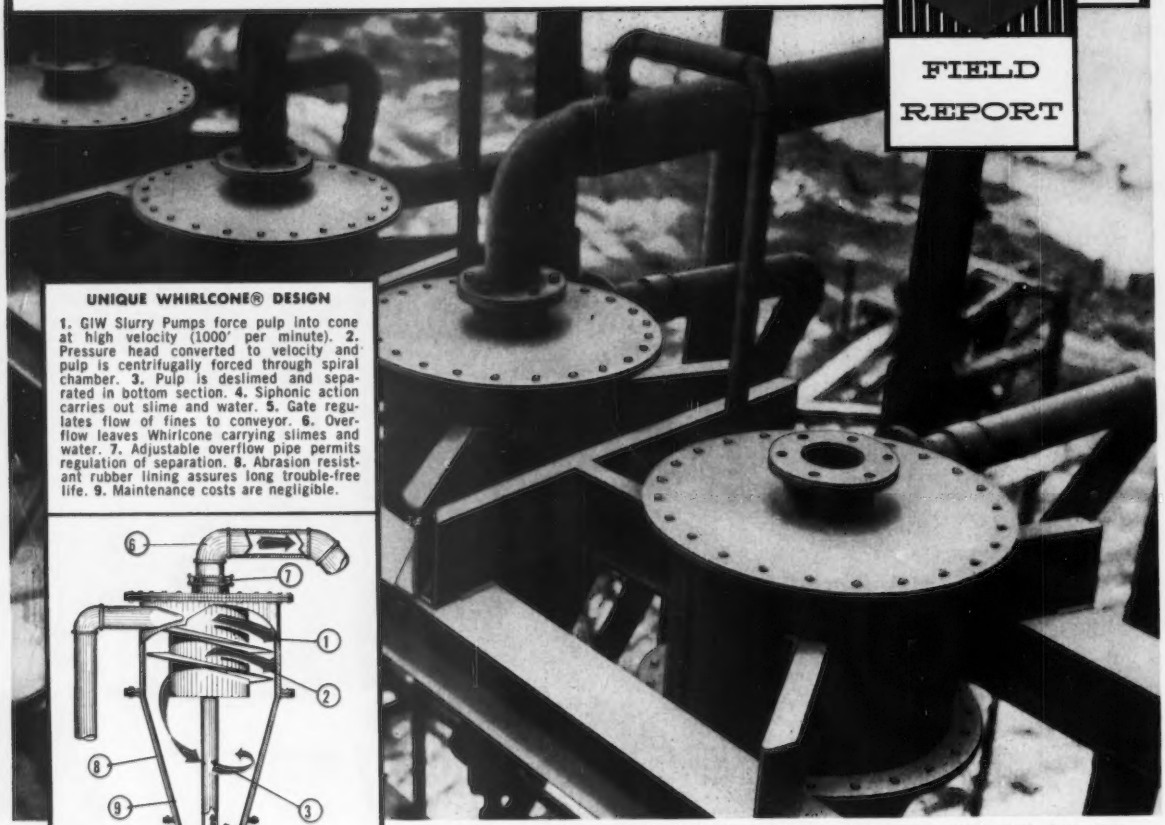
COTTRELL WHIRLCONE® SEPARATORS

customer:

BECKER COUNTY SAND & GRAVEL CO.

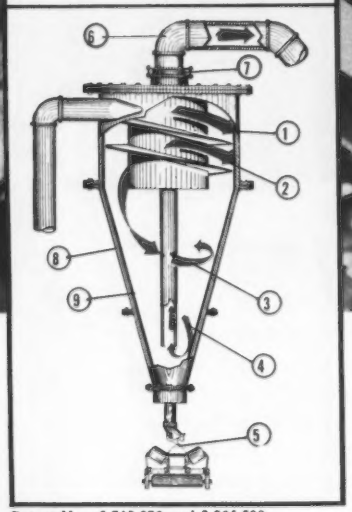
GIW

FIELD REPORT



UNIQUE WHIRLCONE® DESIGN

1. GIW Slurry Pumps force pulp into cone at high velocity (1000′ per minute). 2. Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. 3. Pulp is deslimed and separated in bottom section. 4. Siphonic action carries out slime and water. 5. Gate regulates flow of fines to conveyor. 6. Overflow leaves Whirlcone carrying slimes and water. 7. Adjustable overflow pipe permits regulation of separation. 8. Abrasion resistant rubber lining assures long trouble-free life. 9. Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25" dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

The retention of fines in the −50 plus 200 mesh range posed a disturbing problem for the Becker County Sand & Gravel Co., of Cheraw, S.C., primarily because the large amount of water used in processing the sand and gravel washed out the desirable fines with the minus 200 slimes.

Fourteen 25" dia. Whirlcone® wet type cyclones installed parallel in four Becker plants solved this problem completely. Operating an average of 8 hours daily, they extract up to 100 tons of clean, fine sand per hour from wash water while the minus 200 mesh slime is discarded.

Recovered fines are used to bring sand up to specifications. Thousands of tons of valuable sand, formerly lost, soon paid for the low cost of the Whirlcones®.

GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6" to 50". Capital cost including the pump is 20 to 50% of conventional classifiers.

If you are losing fines from material −12 mesh to lightest slimes, write today. Recommendations and literature will be forwarded promptly.

COTTRELL ENGINEERING
Division of
GEORGIA IRON WORKS CO.

GIW

Manufacturers of pumps, dredges, separators and accessories.

AUGUSTA • GEORGIA

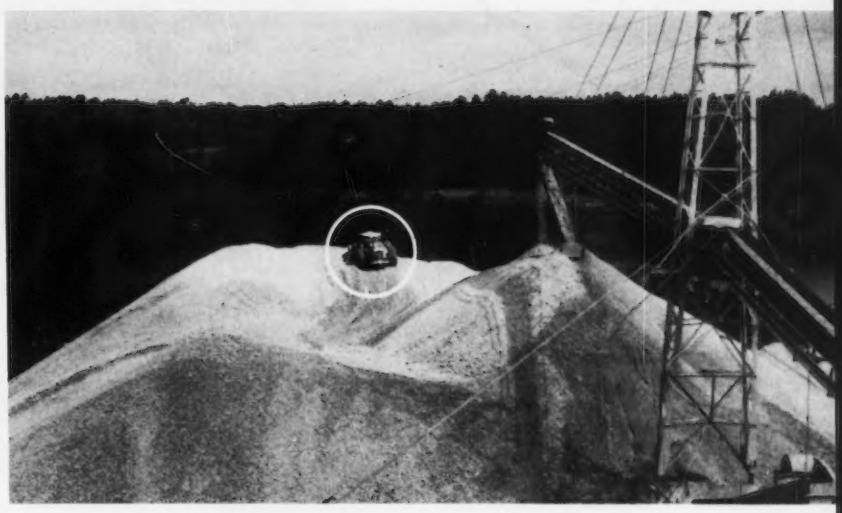
Switch in tractors means big savings

for Hedrick Gravel and Sand Co.

B. V. Hedrick Gravel and Sand Co., Salisbury, N.C. produces up to a million tons of gravel and sand yearly at its 2000-acre Rockingham quarry. Until a couple of years ago, the firm used two 120-hp crawler-tractors for clean-up and miscellaneous jobs. But, as is usual wherever footing is abrasive, track maintenance costs were sky-high. In addition, the crawlers took far too long to travel long distances between job assignments.

This situation, management realized, called for a mobile rubber-tired tractor. And time studies showing actual tractor *work time* indicated that probably only one of these new, mobile tractors would be needed:

The firm found what it was looking for in powerful, speedy, 218-hp LeTourneau-Westinghouse Tournatractor®. Of the switch in tractors, Gen. Mgr. E. A. Goodman, Jr. today says, "This single rubber-tired tractor certainly meets our need . . . it drives job-to-job very effectively." Adds operator Luin Tucker, "It's fast and makes my job twice as easy. It'll do more work than the two crawlers did, and maintenance is low."



Maintains stockpiles — With 12'-wide dozer blade, Hedrick's Tournatractor efficiently spreads conveyor-dumped gravel. With big, multi-disc air brakes — totaling 3,762 sq in. of brake surface — operator has sure, safe control, giving him confidence to work near pile's edge.

Illustrated and described here are a few reasons why Hedrick's rubber-tired L-W tractor gets more work done faster . . . safer . . . at less cost.

Why don't *you* check on savings possible with a LeTourneau-Westinghouse high-speed Tournatractor at your pit? Ask for details and demonstration. No obligation.

CT-2008-MQJ-1

Handles clean up — L-W Tournatractor cleans up around hoppers, draglines, rail sidings. Unit also spots RR cars. Gear shift is instantaneous . . . operator can always apply effective pulling, pushing power without loss of vital momentum.

Clears brush, strips overburden — Powerful Tournatractor clears brush, topples trees, and strips overburden from new mining area. Tractor's 4 big, high-flotation tires provide excellent traction. Blade is controlled by instant-acting electric motor.

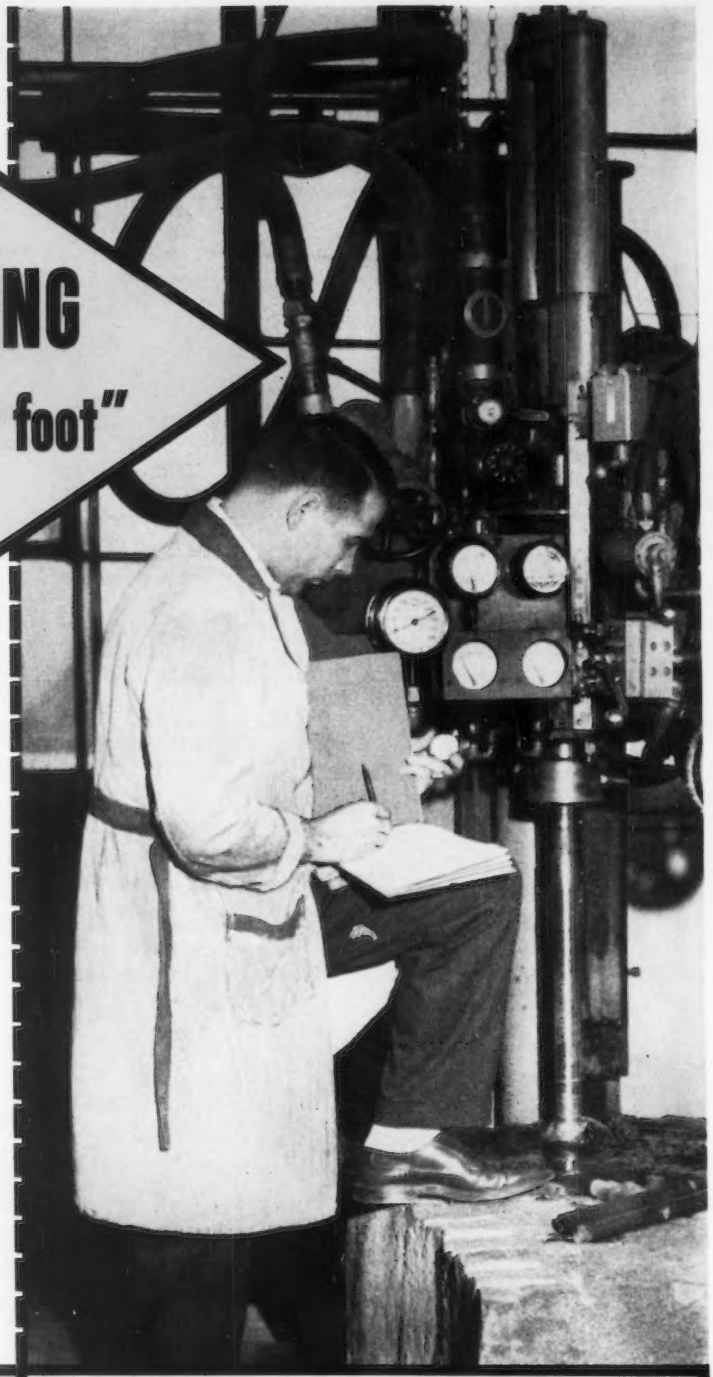
Travels anywhere — 17-mph L-W tractor drives anywhere under its own power. When traveling between assignments, Tournatractor handles haul-road maintenance, improves drainage—keeps haulers moving at safer, more profitable speeds.

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

PRE-TESTING
MEANS
"less cost per foot"



The fundamental purpose of all Christensen Diamond bit research, whether in the field or in the laboratory, is to improve diamond bit performance.

This hydraulic diamond test drill, located in Christensen's main plant, provides a means of testing new bit designs, matrix composition and diamond sizes or patterns in a variety of rock types before field testing.

The rock used for these preliminary tests is gathered from many areas in the country and is selected from formations encountered in actual drilling operations.

These specialized tests enable Christensen engineers to increase penetration rates and improve bit life by determining the matrix materials and bit designs that assure the best results in each rock type.

For the right bit for your drilling requirements, call the nearest Christensen representative and learn how you can operate at "less cost per foot."

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

LeTourneau-Westinghouse Rear-Dump casts 11 tons of steaming slag over edge of waste dump. Unit travels 10 mph faster than smaller competitive hauler working at same location.

How big chemical firm hauls phosphate ore, hot slag, with Rear-Dump and Scraper

In Central Idaho, a large phosphate producer mines phosphate ore and processes it into liquid phosphorus. Two of the most important haul units in the firm's operation are powered by LeTourneau-Westinghouse 138 hp Model D Tournapulls®.

One "D" prime-mover is hooked up to the standard 9-yd. Tournapull scraper. It is used to load ore from stockpiles, and haul it to grizzlies feeding the plant's conveyor line. The other prime-mover powers a LeTourneau-Westinghouse 11-ton Rear-Dump. This unit hauls slag from the plant pit to a waste dump.

2 tons more per load ... 10 mph faster

The L-W Rear-Dump, together with another dump unit, haul approximately 30,000 tons of hot slag a month. Carrying an average of 11 tons ... compared to 9 for the competitive unit ... the "D" hauls 835', dumps and returns, in an average of 4.25 minutes. On the haul, this heavy-duty unit is proving about 10 mph faster than the rival dumper.

Scraper hauls ore, digs ponds

"D" scraper teams with a tractor-drawn scraper to move 1800 tons of raw ore a day, in two 8-hour shifts. Fast, maneuverable Tournapull also handles many other scattered dirt-moving jobs. Last year it did about 90% of the excavation work for two settling ponds — each 1,000' x 35' x 20'. A third pond of this size is on the immediate work schedule for this machine.

Trailing units interchangeable

The company keeps both its Tournapulls working almost full time, and therefore has individual prime-movers for each. The Rear-Dump and scraper, however, are interchangeable behind the same standard Tournapull prime-mover ... and can be switched in a few hours for two-way versatility.

Call or write for specifications on Tournapull Rear-Dumps, scrapers, and other rubber-tired LeTourneau-Westinghouse units that can speed production and cut costs at *your* pit.

Wide, unobstructed bowl of Rear-Dump provides easy target for shovel. Hauler maneuvers easily, spots fast at shovel and fill. It turns full 90°, can make complete U-turn in less space than its own length.

"D" scraper loads ore, hauls it to grizzlies ... handles other jobs, like digging ponds. Scraper and Rear-Dump units are interchangeable behind any "D" prime-mover.

DRDP-1564-MQJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

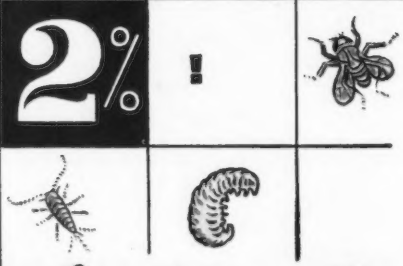
A Subsidiary of Westinghouse Air Brake Company

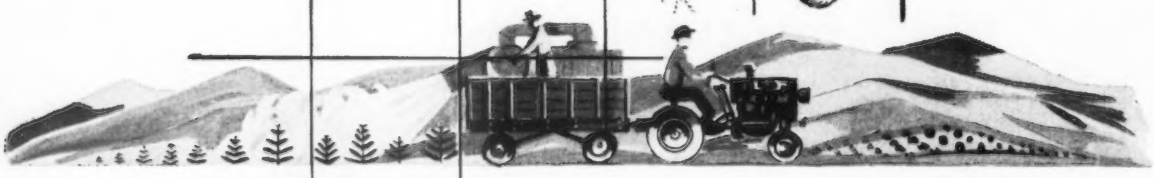
Where quality is a habit

SULPHUR

ONE OF THE FOUR STRONG PILLARS OF PROCESSING

...BUT WHAT A 2% !





A recently compiled breakdown of Sulphur consumption in the United States, shows about 2% of the Sulphur goes into the manufacture of insecticides and fungicides.

Not much, perhaps, as tonnages go but no other use of Sulphur is more important with the possible exception of the 'wonder' drugs. It doesn't take much imagination to picture what would happen if the bugs and parasites were allowed to take over our crops and trees. Sulphur, along with other chemicals, is helping to protect our food supplies and foliage.

The role that TGS is playing in this constant fight against crop destruction is to see to it that the manufacturers of the insecticides and fungicides *always* have a ready supply of Sulphur, both solid and molten. This constant production and centralized distribution coupled with technical help is our contribution to industry.

SULPHUR PRODUCING UNITS

• Newgulf, Texas • Spindletop, Texas
• Moss Bluff, Texas • Worland, Wyoming
• Fannett, Texas

TEXAS GULF SULPHUR CO.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

YES ☐ or NO ☐ ?

Photo shows how a regular program of maintenance with grader can keep haul routes smoother . . . can help you boost the number of hauler round-trips. Grader is raising the practical speed-limitation of this road *at least 5 mph*. How many extra tons would that produce at your digging . . . daily? . . . yearly?

Are you getting top possible output? Is your cost-per-ton as low as can be?

Check your answers to the following questions. Then consider how the services of additional, fast-working graders — or more extensive use of present machines — can step-up output . . . cut operating costs . . . boost net profit.

Yes ☐ No ☐ Do you blade haul roads regularly? Smooth-graded roads speed hauling, for more trips per day . . . cut hauler downtime, reduce tire wear, make roads safer.

Yes ☐ No ☐ Do you keep pit floors clean? Do you clean-up quickly after blasting? A regular program of clean-up pays-off. Maintenance of wide, clear traffic-ways makes all areas quickly accessible by shortest route. It speeds loading and hauling . . . prevents accidents . . . reduces wear on tires and machines. Regular clean-up, and good drainage prevents dirt and refuse from weathering into ore, minerals, or coal below the floor.

Yes ☐ No ☐ Do you practice good housekeeping around plant? A clean plant area speeds equipment traffic, reduces dust, increases efficiency. It pays to keep roads, runways, and working areas neat, clean, and workable at all times by leveling or removing fall-off from heaped trucks . . . spillage from around crushers, grizzlies, conveyors, trestles, etc.

Yes ☐ No ☐ Do you keep stockpile toes pushed in? Scattered piles limit working space, tend to down-grade material, increase loading costs. A regular program to roll-back thinly-spread toes costs little, pays-off big in time and material saved.

Yes ☐ No ☐ Do you keep dumps smooth and level? You speed hauling and dumping, cut costs, when dumps are smooth, level, dry. A grader can handle dump maintenance and drainage quickly. Its offset blade reaches far out beyond wheels to safely cast material clear over edge. And as it travels to-and-from the dump, grader smooths your haul road.

Yes ☐ No ☐ Do you promptly clean washed-down dirt off benches? Every rain may wash dirt onto upper benches . . . may lower the quality of rock and ore below. Prompt grader service halts "wash," provides planned drainage, piles refuse for easy removal by scraper or loader and truck.

Yes ☐ No ☐ Do you put a grader on your exploration or development "teams"? A modern grader can build a smooth well-drained roadway in a matter of hours . . . can speed exploration work by maintaining good access roads for quick transport of men, supplies, and equipment.

Yes ☐ No ☐ Do you keep ditches clear . . . drainage open? Just a few hours of grader work per week on ditches along roads, in pit, and elsewhere, will keep drainage open . . . assure fast run-off. A planned drainage system and a regular maintenance program prevents seepage of dirty water into pit bed . . . minimizes break-up of haul roads . . . keeps haulers and shovels operating on dry footing.

Before you buy any grader, be sure to get complete information about fast, powerful, L-W Adams† Model graders. These LeTourneau-Westinghouse machines are offered in weight, power, and price-ranges that will exactly fit your needs. Seven models: 190, 160, 135*, 123, 115, 80, 60 hp. Choice of GM or Cummins engine on 6 larger models. Write for details.*

*With torque converter †Trademark G-1872-MQ-7

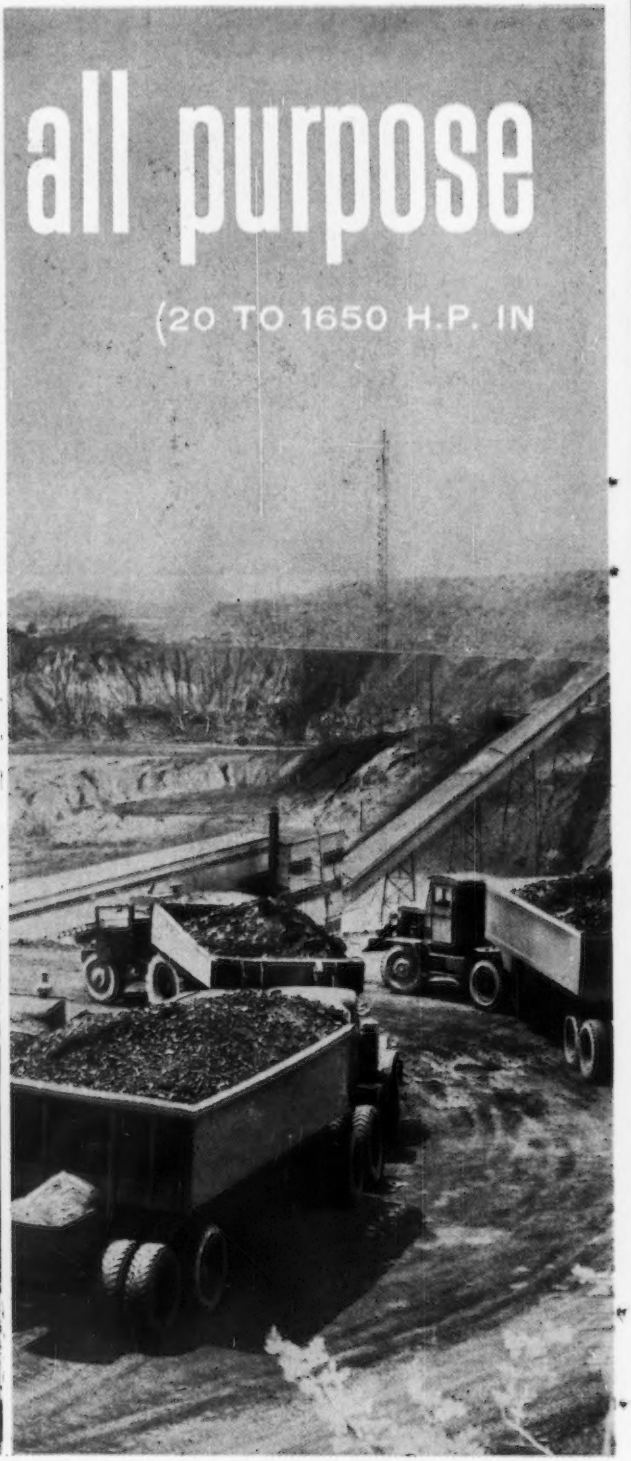
LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

4 GREAT NEW ENGINES IN THE all purpose

(20 TO 1650 H.P. IN



THE GM DIESEL ALL-PURPOSE POWER LINE 20 to 1650 H.P. in only 3 cylinder sizes

NON-TURBOCHARGED RATINGS

NEW "2-53" 20 to 47 H.P.

"2-71" 33 to 67 H.P.

NEW "3-53" 38 to 97 H.P.

"3-71" 51 to 118 H.P.

NEW "4-53" 51 to 130 H.P.

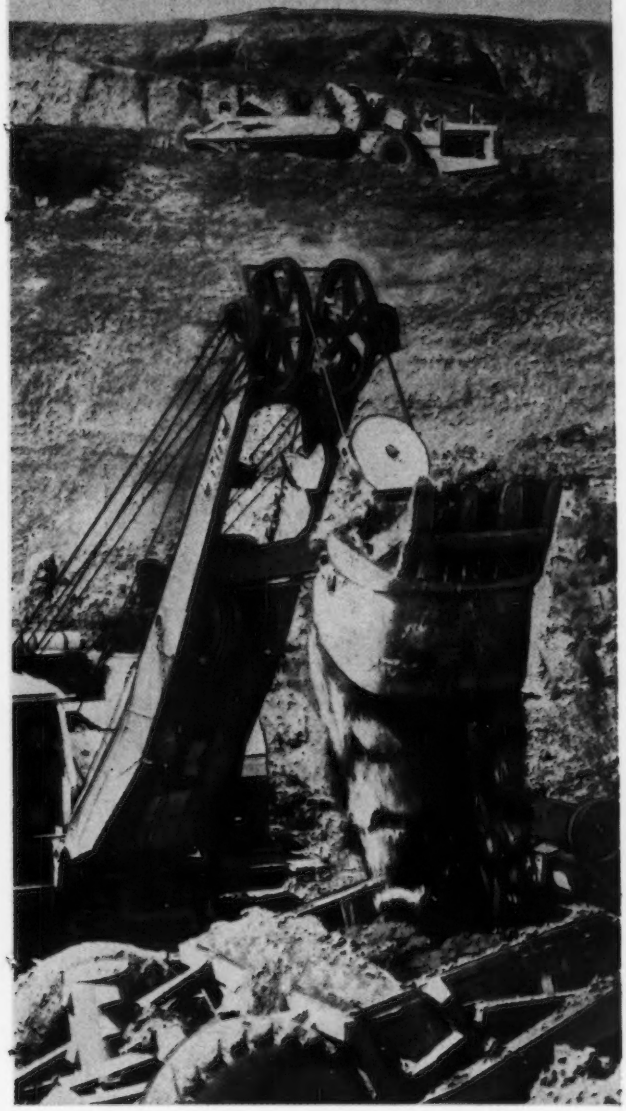
"4-71" 69 to 167 H.P.

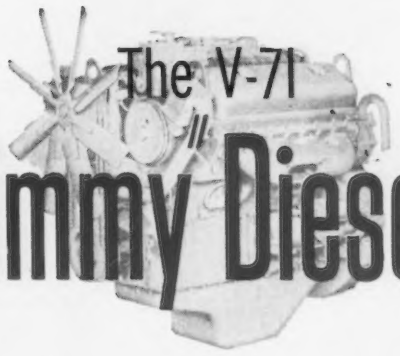
NEW "6V-53" 76 to 195 H.P.

"6-71" 112 to 252 H.P.

power line

ONLY 3 CYLINDER SIZES)





The V-71 "Jimmy" Diesels

NEW FOR THE MINING INDUSTRY
6, 8-, 12-, and 16-cylinder "V" versions of the famous GM Series 71 Diesel

The new V-71 "Jimmy" Diesels are a further illustration of GM Diesel's mighty new power concept —rounding out the All-Purpose Power Line—yet retaining the GM Diesel family relationship and parts interchangeability.

Here are engines that combine every profit-making, cost-saving advantage any Diesel has ever had. Diesels that boast an ingeniously engineered combination of new compactness, lightweight, high efficiency, durability and inexpensive maintenance.

These V-71 "Jimmy" Diesels are available in 6-, 8-, 12-, and 16-cylinder models rated from 112 to 675 h.p. plus 24- and 32-cylinder "Twins" up to 1650 h.p., when turbocharged. They're itching to get to work wherever there's hard work to be made easy.

To see how these new members of the All-Purpose Power Line meet your needs, write GM Diesel, Dept. M-3, Detroit 28, Michigan.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada, GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

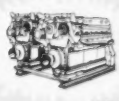
NEW
"6V-71"
112 to 252 H.P.

NEW
"8V-71"
150 to 334 H.P.

"6-110"
160 to 335 H.P.

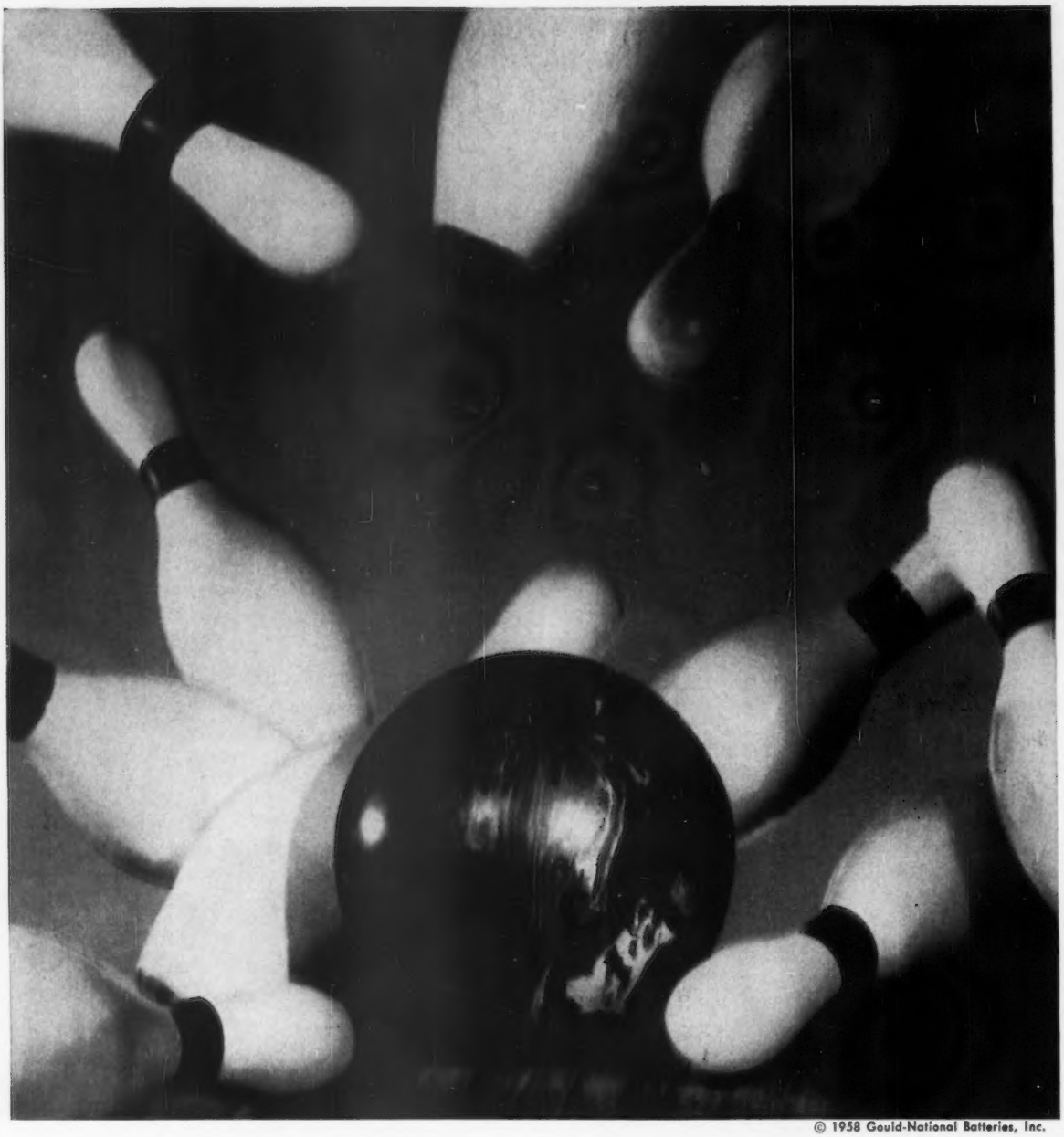
NEW
"12V-71"
224 to 504 H.P.

NEW
"16V-71"
300 to 675 H.P.



NEW
"24V-71" (Twin 12)
448 to 1008 H.P.

NEW
"32V-71" (Twin 16)
600 to 1350 H.P.
(Turbocharged—1650 H.P.)



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STRIKE HARD *at today's high operating costs*

. . . specify **gould** *batteries*

America's Finest!
GOULD
Shuttle Car and
Locomotive Batteries

You can be sure of lowest battery costs and highest operating efficiency —year in, year out—with Gould Batteries. Why? Because there's a *cost-reducing benefit* behind every feature, of every battery in the Gould line.

That's why it pays you to standardize on Gould. Call your local Gould representative for details. He's listed under "Batteries, Industrial" in the Yellow Pages. Gould-National Batteries, Inc., Trenton 7, N. J.

More Power to you from Gould

Always Use Gould-National Automobile and Truck Batteries

call KE for plant expansion or new facilities

INGENUITY

has made KE a major engineer-contractor serving Minerals

Design of a concentrating plant to process 60,000 tons of iron ore per day. Open pit bauxite facilities. Coking coal processing plants. Diatomite plants. Cement plants. These are a few of many projects and studies Kaiser Engineers undertakes for the Minerals industries in the United States and world-wide—Quebec, Jamaica, Mexico, Brazil, Australia, New Zealand, Greece, Turkey, India.

From determination of process through design and construction of complete facilities, KE can perform any or all steps. And perform them with Ingenuity—to produce a more efficient operation, in less time, at lower cost.

For your next facility—whether ferrous, non-ferrous or non-metallic—call KE.

Pendulum ore conveyor—Ingenuity produced KE innovation distributing beneficiated iron ore in 180° crescent: conserved space, cut rehandling costs.

KAISER ENGINEERS

KAISER ENGINEERS engineers-contractors
Contracting since 1914

Division of Henry J. Kaiser Company · Oakland 12, California · New York, Pittsburgh, Washington, D. C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

4880

FOR MAINTAINING HAUL AND ACCESS ROADS, the No. 14 pays off with high capacity and high availability. Its Turbocharged Cat Engine packs the power to utilize a 12-ft. or 14-ft. blade at highest practical working speeds!

CATERPILLAR'S PROJECT PAYDIRT

PAYS OFF FOR YOU AGAIN

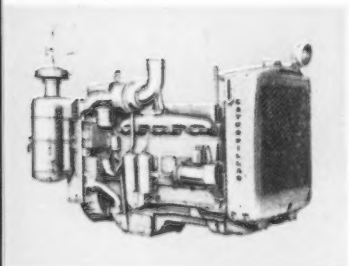
Big new Cat No. 14

MOST VERSATILE BIG GRADER EVER DEVELOPED

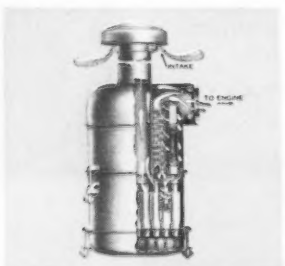
In the new No. 14 Series B, Caterpillar brings you the most versatile grader ever developed in the "big machine" field. Another major achievement in Caterpillar's "Project Paydirt," it answers your need for a unit that comes through dependably with higher, faster, lower-cost production on your tough road maintenance and construction jobs.

The first and only Turbocharged motor grader, the 150 HP No. 14 operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. It is built with extra strength to match its power and weight. It incorporates the latest engineering advances developed by Caterpillar research.

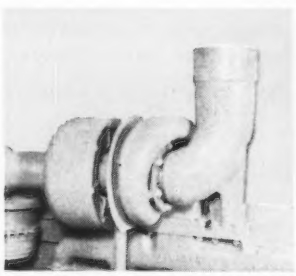
Example: New design permits increased clearance between moldboard and circle for greater loads. You'll also find exclusive time-tested Caterpillar developments. Example: The oil clutch. Some of these features are listed here, but there are many more. They all pay off in this one fact: You can use the No. 14 profitably anywhere.



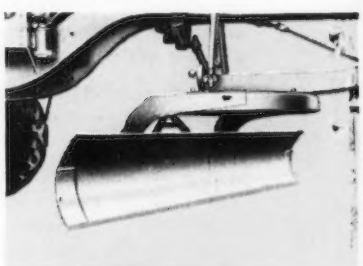
TURBOCHARGED CAT ENGINE: First and only Turbocharged engine in a grader. Its high torque rise of 18% pays off on your job.



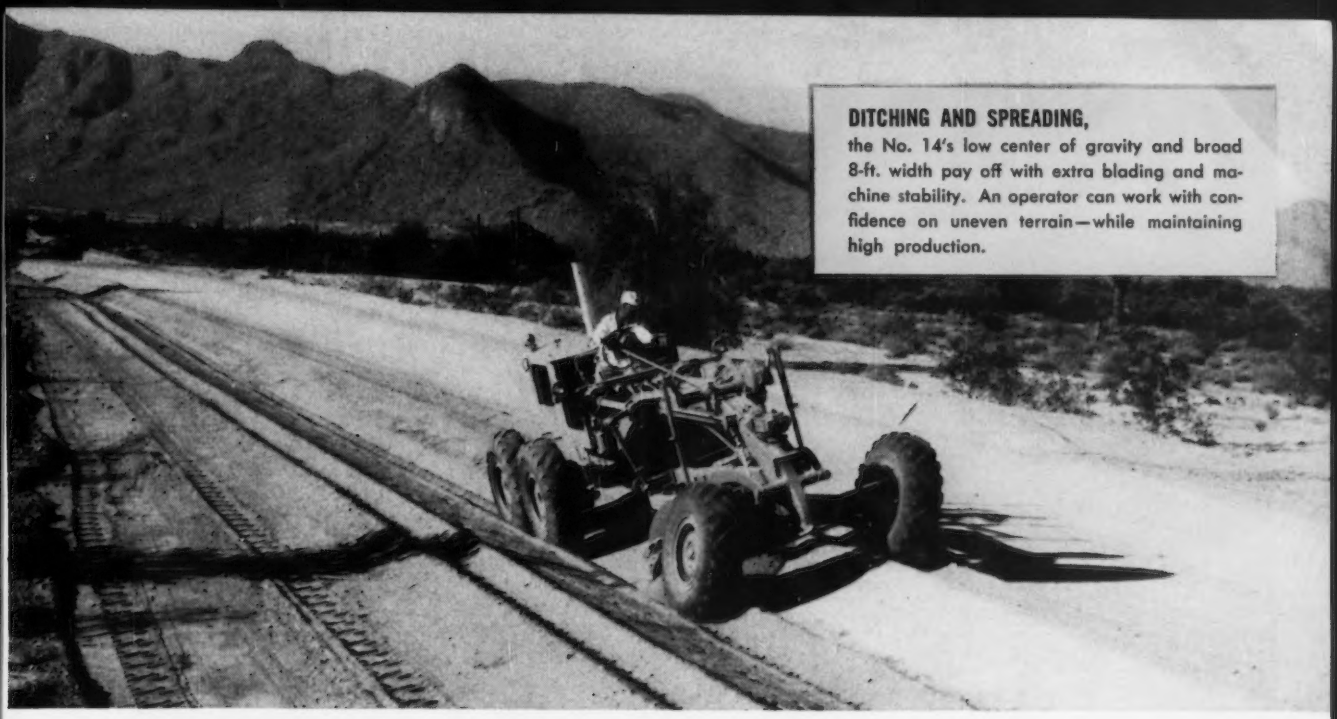
NEW DRY-TYPE AIR CLEANER: Removes 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes.



NEW TURBOCHARGER: Close-up of Cat Turbocharger which greatly increases over-all engine performance. First such unit in any motor grader.



HIGH THROAT CLEARANCE: New design permits increased clearance between moldboard and circle for unexcelled rolling action.



DITCHING AND SPREADING, the No. 14's low center of gravity and broad 8-ft. width pay off with extra blading and machine stability. An operator can work with confidence on uneven terrain—while maintaining high production.

Turbocharged Motor Grader

...WITH HIGH CAPACITY FOR EVERY APPLICATION!

As a result, you don't have to pick "spots" to make the No. 14 a sound investment. This modern, all-purpose big grader will earn its keep on every application with high capacity and low operating cost. But see for yourself. Get the complete facts from your Caterpillar Dealer. Just say when and where—he'll demonstrate.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

✱***PROJECT PAYDIRT:*** Caterpillar's multi-million-dollar research and development program—to meet the continuing challenge of the greatest construction era in history with the highest production earthmoving machines ever developed.

EXCLUSIVE OIL CLUTCH: Provides up to 2,000 hours' service without adjustment, equal to about 12 months' "adjustment-free" operation.

PRECO AUTOMATIC BLADE CONTROL: Another Caterpillar exclusive, optional on the No. 14. Operator selects desired slope on dial. Now transistorized for freedom from maintenance and adjustment, the unit automatically maintains blade slope within ⅛ in. in 10 ft.

POWER STEERING AND POWER BRAKES: Provide fast, positive response and ease of operation that help operator maintain high production anywhere.

TUBELESS TIRES—14.00-24 (10-PLY RATING): All tires mounted on wide 10-in. rims to stiffen tire side-walls and reduce tire "roll." Large tires on front end improve machine stability.

UNEQUALED VISIBILITY: An operator, while seated, has an unobstructed view of critical areas at the front wheels, blade toe and circle.

NEW TURBOCHARGED NO. 14

Engine HP (rated at sea level)	150
Weight	29,280 lb.
Blade—standard	12 ft.
Optional	14 ft.
Tires—all around	14.00-24
Travel speeds—6 forward, 2 reverse	2.6 to 21.6 MPH
Turning radius	36 ft.

A COMPLETE MOTOR GRADER LINE!

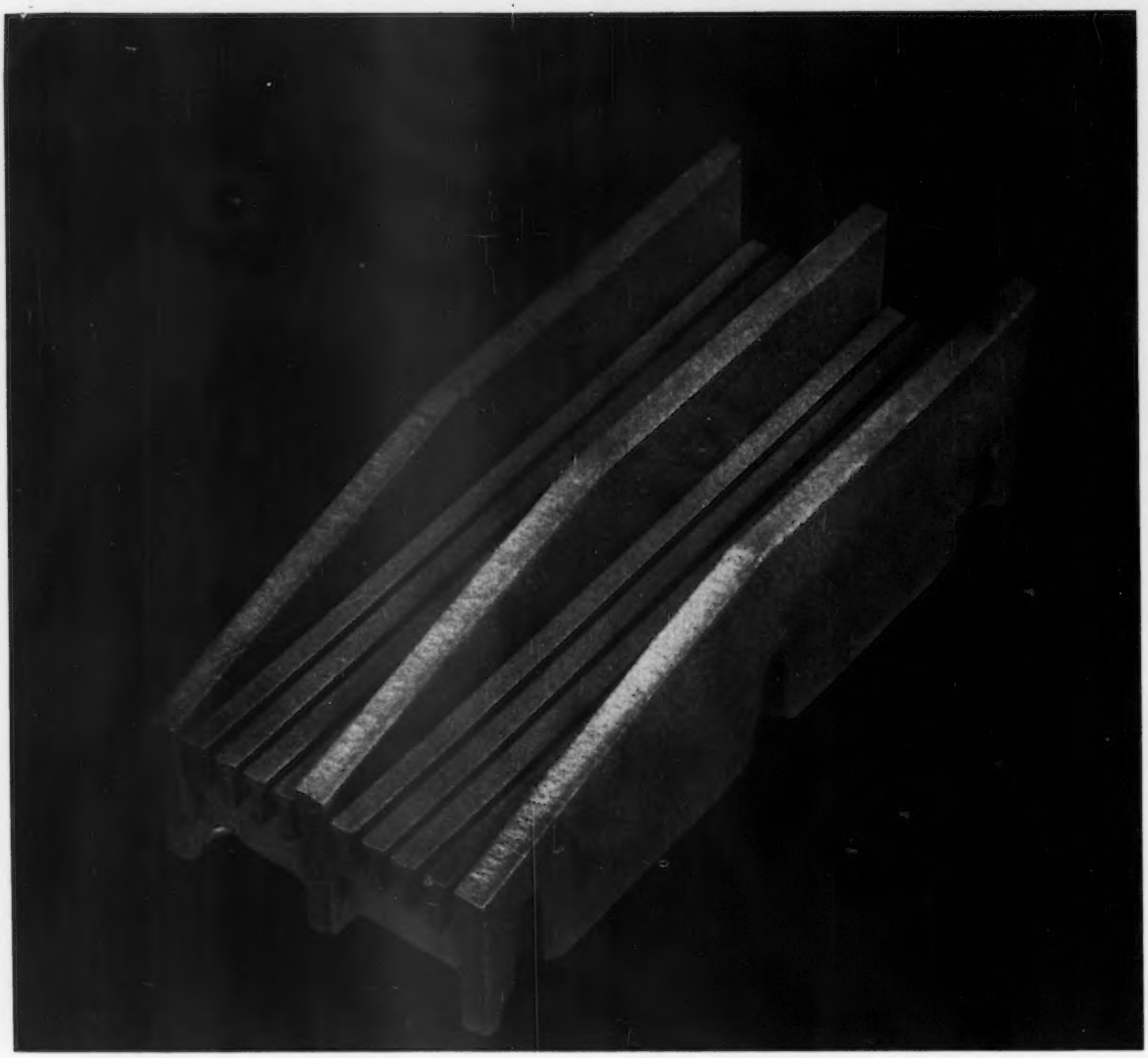
With the addition of the No. 14, Caterpillar now offers a modern, heavy-duty motor grader for every purpose. Other units include the world-famous 115 HP, 23,000 lb. No. 12 and the 75 HP, 20,805 lb. No. 112. Like the No. 14, each is designed to do more work at lower cost with less down time than any unit in its class.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

DIESEL ENGINES · TRACTORS · MOTOR GRADERS
EARTHMOVING EQUIPMENT

BORN OF RESEARCH
PROVED IN THE FIELD



BOULDER BOUNCE won't bruise this screen!

It's Hendrick Skid-Bar Mounted Wedge Slot Screen. The Skid Bars protect the wedge slot screen from large ore chunks. They also reduce wear caused by abrasive action — assure you of a better dewatering job and longer screen life.

Here's an extra plus: CH-12 profile bars on Hendrick Skid-Bar Screens have a thick, parallel head flange which maintains uniform openings throughout the life of the screen.

Hendrick Skid-Bar Screens are fabricated to fit your exact requirements. For further information, write Hendrick today.

HENDRICK

MANUFACTURING COMPANY *70 Dundaff Street, Carbondale, Pa.*

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel Flooring — Shur-Site Treads • Armorgrids • Hydro Dehazers • Distillation Column Internals

Wearpact steel teeth on this bucket last over 8 times longer!

Maybe you don't dig anything as tough as slag—but the experience of The Holmes Construction Company, Wooster, Ohio, can still point the way to savings on *any* dipper tooth application.

They were using so-called wear-resisting teeth on a backhoe bucket . . . teeth that needed replacement in 1 to 3 days. As a trial, they installed one Wearpact Steel tooth on the bucket . . . *and it outlasted competitive teeth over 8 to 1!*

An average of over 1 months' service instead of 1 to 3 days . . . does this suggest a way for you to save money?

Now is the time to find out about longer-wearing, dollar-saving Wearpact . . . the new high-hardness steel—about 500 Brinell—that's ductile and tough. Write today for complete information!

Cut your costs with WEARPACT

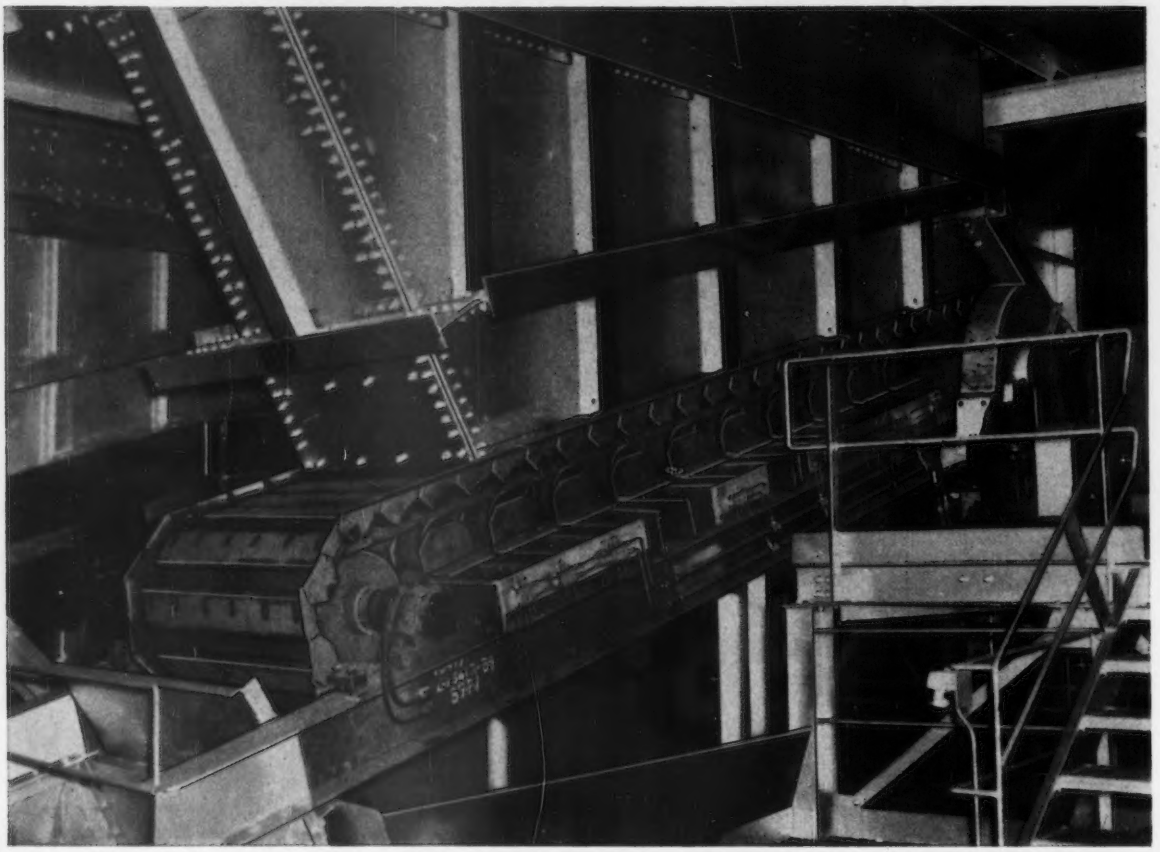
CAST ALLOY STEEL

A product of

AMERICAN STEEL FOUNDRIES

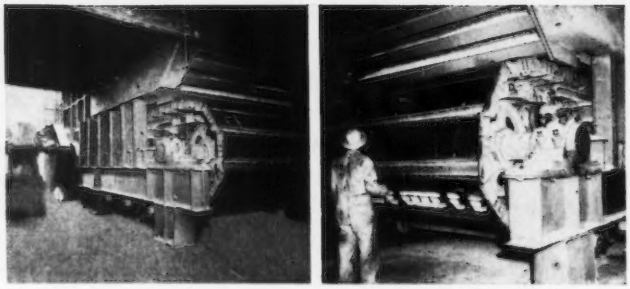
3700 Canal St., Indiana Harbor, Indiana

STEPHENS-ADAMSON



FEEDERS FOR BIG TONNAGE CONTROL AT LOWEST OPERATING COST!

The experience of STEPHENS-ADAMSON engineers in the design and construction of Feeders and Apron Conveyors extends from the handling of Potash at Carlsbad, New Mexico to the gold mines of Africa, from the nitrate and copper mines of Chile to the giant Seven Islands iron ore range in Canada. From light duty units to giant AMSCO Feeders built to take the impact delivered by thousands of tons of run of mine, ore and stone, S-A engineers have a world of "know-how" in the design of efficient, profitable Feeders. STEPHENS-ADAMSON engineers will be happy to work with you on any bulk materials handling problem.



AMSCO Manganese Steel Pan Feeders handling copper ore at a Southwestern mine.

WRITE FOR BULLETIN 255

S-A

ENGINEERED BULK HANDLING SYSTEMS
STANDARD MATERIALS HANDLING PRODUCTS
SPEEDWALK® PASSENGER CONVEYORS
SEALMASTER® BALL BEARING UNITS
SPHERCO® BEARINGS & ROD ENDS

ENGINEERING DIVISION

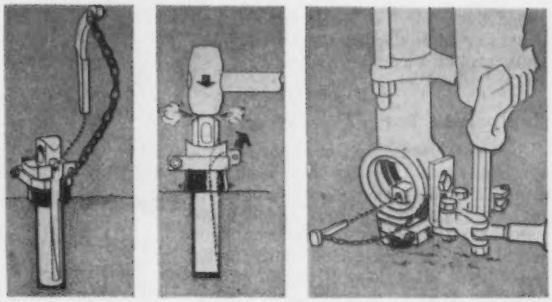
STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 4 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

E&MJ NEW PRODUCTS DIGEST

In this issue—six new drills, a foam plastic map, a dry-type engine air cleaner that removes more than 99% of the contaminants, and other product and literature notices.



ANCHOR BOLT is locked in short hole by chained wedge. Rubber collar around neck allows downward blow to free wedge. Slotted-ring on end of feed cylinder is firmly fastened to anchor bolt by wedge. Rod centralizer is attached to ring.

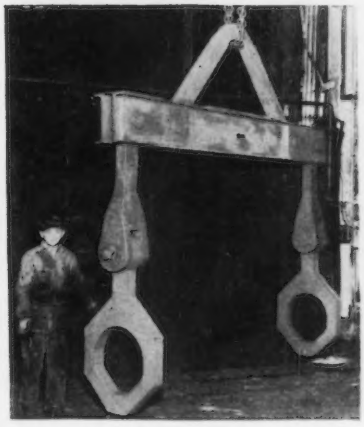
Piston-Feed Drill Bolts To Rock (1)

ATLAS COPCO's "Bencher" is an intermediate alternative to hand-held and tripod—or wagon-mounted rock drills. It permits one man to operate two machines at one time. With two such BMP 31 Benchers, one man drilled 750 ft on one shift in granite in Sweden. The unit, exclusive of the rock drill, weighs 90 lb and handles 5-ft steel changes.

The apparatus consists of three main components: the rock drill; the pneumatic piston feed cylinder with drill yoke attached to the piston rod; and the short anchor bolt. Anchor bolt holes are drilled 1¼x8-in. with a small hand-held machine. After an anchor bolt is wedged in place, the feed cylinder is attached by a locking wedge. The cylinder can be tipped slightly off vertical if desired. During drilling additional anchor bolts can be prepared.

Hydroleg Rock Drill (2)

Holman Bros. Ltd. has developed a rock drill that employs water rather than air to operate the leg cylinder. Water pressure required is 60 to 150 psi. Two sizes are available—39 and 52 in. feed length. Drill mounts have been supplied to accommodate many types of electric and air operated rotary drills.



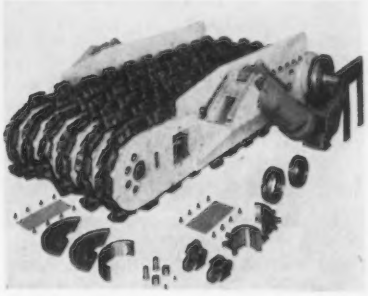
Copper Bail (3)

Structural steel bail used to operate a 200 cubic ft ladle of molten copper slag in a new southwestern U.S. copper smelter has been produced at American Forge & Mfg. Co. It weighs 3¼ tons and has an over-all height of 11 ft. Crane operator can unhook the bail from the ladle without assistance. The bail was designed and installed by Western-Knapp Engineering Co.

For more information on products and literature circle the proper number on the card and mail to E&MJ.

Reverse Rotation Drill (4)

Ingersoll-Rand is introducing a heavy-duty, deep-hole hammer drill that uses conventional (left hand) as well as reverse rotation. Drill is called the Model D40 and has a 4-in. bore and will handle bits up to 3-in. dia.



Multi-Bar Ripper Head (5)

Bowdil Co. has developed the ripper head shown above which features interchangeable chains, sprockets; independently adjustable cutter bars, improved hard surfaced wearing shoes, and—sprockets which are clamped to an oversize shaft, locking the shaft and the sprockets into an integral unit equivalent in strength to a 9-in. dia shaft.

Air Motors (6)

A new line of Joy Pistonair five-cylinder, radial air motors for heavy-duty service, having extremely high starting torque and sustained load-lugging ability has been announced by Joy Mfg. Co. Motor horsepower ratings range from 11½ to 20 at 90 psi, and according to Joy repeated overloads and stalls cannot harm the motor.

Explosives Bag (7)

The development of an explosive bag for packaging powders has been announced by Bemis Bag Co. Bag is three-ply, multiply creped kraft paper outer tube and a seamless polyethylene liner which can be heat sealed through the outer layer. Bags have been left in wet holes for as long as seven days without damage. Bag is also oil resistant.

Bemis also makes another interesting item—a shock absorbing bag (a poly bag filled with shredded paper or other highly resilient material) that is dropped into the bottom of a dry blast hole.

Twisted Rail Spike (8)

Jones & Laughlin Steel Corp. will manufacture and sell the patented Spencer-Spike track spike that provides better holding and a tighter grip on tie plates through a simple twist in the shaft of the spike. Spencer-Spike is said to reduce the kind of wear shown in the spike at the right above.

Hex Wrench (18)

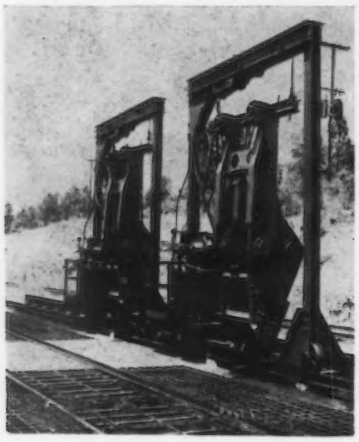
Ridgid Tool Co. is introducing a hex wrench with an adjustable 4-sided jaw that's easy to put on or take off. Angle jaw provides more leverage and a positive grip on hex, square, valve packing nuts, unions and gas cocks. Several sizes are available.

Shrouded Blocks (21)

Sauerman Bros., Inc. Durolite blocks are now available with shrouded housing to insure proper seating of the running rope. Shroud reduces breakage and cable wear.

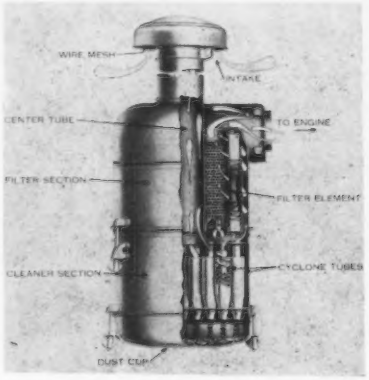
Foam Plastic Relief Maps (9)

Foamed plastic topographical models are now available in molded light-weight construction in various colors from Industrial Models, Inc. (Del). Material can be cut easily with a knife or saw. Any horizontal or vertical scale can be employed. Vertical scale is often exaggerated.



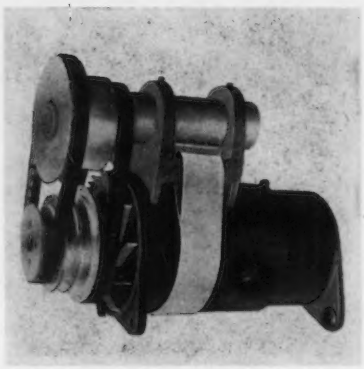
Hydraulic Car Shaker (10)

Carquake is the trade name applied to Stephems-Adamson Mfg. Co. hydraulically operated car shaker which is available in two models, one stationary (B), the other rail mounted (C). No additional structure or controls are needed.



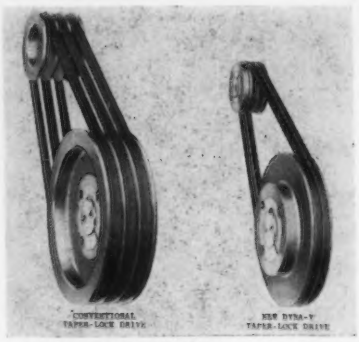
Dry Type Air Cleaner (11)

Designed for the D8 and D9 Caterpillar tractors, the unit shown above has an operating efficiency of 99.8% and is effective at any engine speed. Caterpillar Tractor Co.'s air cleaner combines a cyclone tube pre-cleaner section and a disposable resin-impregnated cellulose after filter. Bottom dust cup needs to be cleaned only once a day. Cellulose filter can be cleaned and reused. When the engine starts to smoke, it's time to clean the filter.



Generator Overdrive System for Automobiles (12)

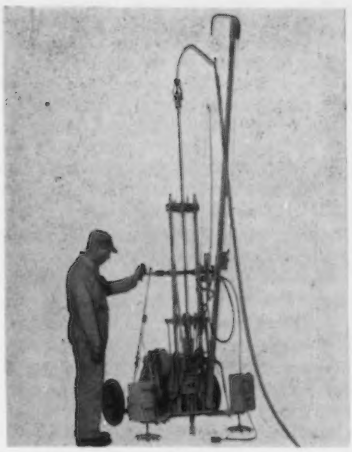
A generator overdrive system is available from Consolidated General Products that creates instant increased generator rotation when the engine is idling or running at low speeds, and which cuts out as the engine takes up the slack. Gen-O-Drive requires less than ¾ hp to operate and is easily attached to any automotive generator—standard, heavy-duty or ac.



V-Belt Drives (22)

Introduced under the trade name Dyna-V, a new line of V-belt drives featuring smaller and lighter sheaves and belts of higher capacity at substantially lower cost is now available from Dodge Mfg. Corp. Dyna-V drives are offered in two standard groove sizes—⅜ and ⅝ in. Sheaves in the smaller size (3V) have from one to 10 grooves, for use with horsepower ranging from one to 50. The larger size (5V) includes sheaves with from three to 10 grooves for up to 200 horsepower service.

There is also a 8V size which will be made-to-order with 1-in. belts for horsepower requirements up to 1,500. Taper-Lock bushings are used.

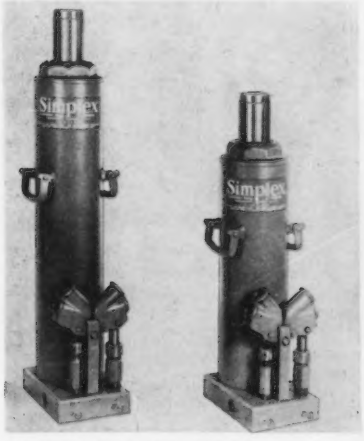


Prospecting Drill (13)

Hossfield Mfg. Co. says that their direct motor drive prospecting drill is widely used for coal, iron, bauxite, clays and uranium prospecting as well as other minerals. Detachable rock bits in standard 1-in. thread in stock sizes from 1¾ to 2⅝ in. fit Hossfield steels. Sampling to 110 ft depth is possible. Unit weighs 1,260 lb, can be knocked down into 100 lb units.

Down-The-Hole Drill (14)

Downhole drill weighing 460 lb and using a Carset bit weighing 126 lb has been added to the Downhole drill line by Ingersoll-Rand Co. Heavy unit will put down 9-in. holes, and offers blasting and drilling cost savings since the size permits wider hole spacing and larger powder charges, according to I-R.

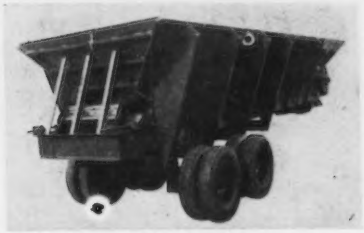


Hydraulic Jacks (15)

Two new high lift hydraulic jacks have been added to the Simplex line by Templeton, Kenly & Co. Both have rated capacity of 25 tons and have high and low speed pumps. Model 25H28 has 28-in. closed height and 22-in. lift. Model 25H22 has 22-in. closed height and a 16-in. lift.

Low Seam Shuttle Car (16)

Type 26 TorKar is only 25½-in. high, yet incorporates all the features of TorKar performance and design. Units have 110 cubic ft capacity which can be increased with sideboards by 8½ cubic ft for every inch of sideboard. National Mine Service Co. now has ac or dc driven single motor shuttle cars in three styles. Three speed forward and reverse transmission, torque converter, four-wheel steer and drive, reversible conveyor are some of the features of TorKar design.



Portable Apron Feeder (17)

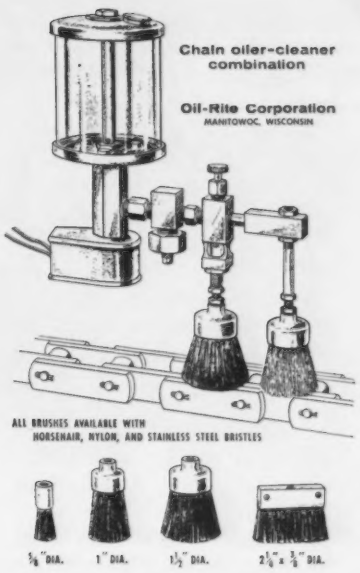
Pioneer Engineering says that their extra heavy-duty apron feeder is 30 ft center to center by 42 in width. Pans are ½-in. forged steel mounted on heavy duty chain riding on steel rollers. Feeder is transported on dual tandem rear wheels. Fifth wheel hitch is provided for towing. Available without the wheels, axles and tires. Power required is 25 hp.

Ripper Chains (23)

Three continuous miner ripper chains featuring improved bit holders have been introduced by Joy Mfg. Co. GV-6111 is an improved standard G-6111 with large round shank holes for reinforced carbide bits and a new type set screw. Type LV-6111 is similar, but offers shorter pitch length—6 3/8 in. as compared to 7½ in. on GV-6111. L-6111 is designed to accommodate the smaller shanked ½x1-in. bits now used on standard chains, but has a shorter pitch (6 3/8 in.).

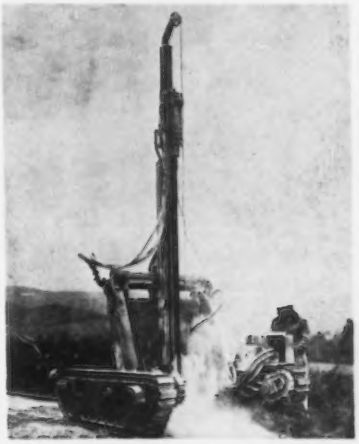
Power Sweeper (19)

The Task Master "42" power sweeper designed by Patch & Kase Corp. employs rear wheel drive, power steering, a stabilized floating main broom, stabilized side broom, and many other features. Enclosed filter bag is easily accessible and the system has an oversized vacuum pump which allows the use of vacuum attachments to clean shelves, bins and out-of-the-way places.



Chain Oiler Brushes (20)

Oil-Rite Corp. offers three bristle materials for their line of chain oiling brushes—horsehair, nylon, stainless steel—in diameters of ⅝, 1, 1½ and a ⅜x2¼ in. size.

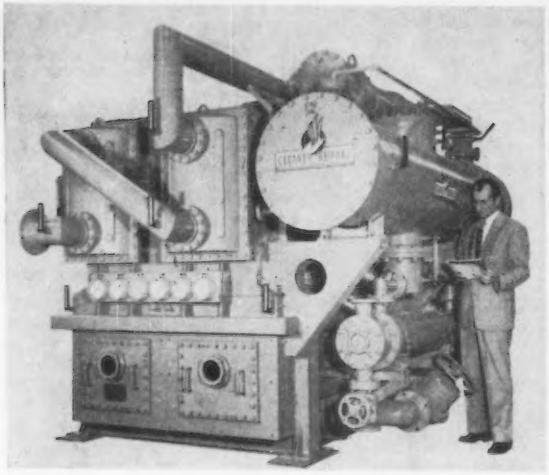


Crawler-Mounted Blastholer (24)

Joy Mfg. Co.'s TDM Trac Drill is completely automatic, air-powered and self-propelled and carried the Joy TM-450 drill, and is capable of drilling 3½ in. dia blastholes to 40 ft or more. Two Joy six-cylinder, radial air motors provide 23 hp for tramming—it can tow a 900-cfm compressor up a 10% grade.

Hydraulic Power Unit (25)

Compact, explosion proof power unit (the Pack-Horse) for use with hydraulic jacks, bolt pullers and other hydraulically controlled components operates from compressed air supply. Unit is contained in a 31x16x15-in. cabinet. One model offers pressures up to 3,000 psi, another up to 6,000. M. B. Sturgis Inc.

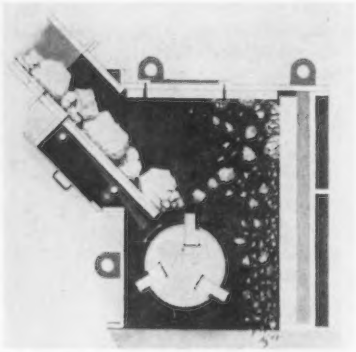


Anaconda to Install Desalting Unit in Chile (26)

Cleaver-Brooks Special Products is providing a 35,000 gpd sea water conversion plant for a new power plant located at Chile Exploration Co.'s Tocopilla, Chile, property. Unit will provide fresh water for reheat steam generator make-up and power plant services. The power plant is located on the sea shore and will generate the power for the mine, mill and smelter at Chuquicamata miles away in the mountains. Desalter is a two-stage flash evaporator containing an evaporator, salt water heater, air ejector, air ejector condenser, piping and instruments in one compact package. The unit is designed to distill 140 tpd of water through 200 psig steam pressure, 560 deg F temperature on feed water having a maximum 75 deg F temperature (minimum 55 deg F) and to guarantee 4 ppm contained impurities in the distillate. Pacific Ocean water at the site assays 19,000 ppm chloride, 336 ppm calcium, 1,327 ppm magnesium, 12.4 ppm silica, 10 ppm suspended solids, 40,280 ppm total solids, specific gravity of 1.0252, and a pH of 8.5. Anaconda's reheat steam generator is designed to operate at 375,000 lb/hour at 1850 psig and 1050 deg F.

Hazemag Impact Crusher (40)

Joy Mfg. Co. will manufacture, sell and service the Hazemag impact crusher in the U.S. Various sizes are available.



Jeffrey Impact Crusher (41)

Feed openings vary from 24x12 to 36x30 in. in the new series of secondary impact crushers introduced recently by Jeffrey Mfg. Co. Impeller bars are heavy cast manganese steel.

Portable Crushing Plants (42)

Designated the 151PR, the first of a new series of portable primary crushing plants is off the assembly line at Pioneer Engineering. Unit contains a 20x36 in. overhead eccentric jaw crusher, a 3x8 ft apron feeder, and a delivery conveyor. Other plants available have 15x36, 24x36 and 30x42 in. crushers.

Measure Dissolved Oxygen (43)

Dissolved oxygen meter which automatically analyzes and records dissolved oxygen content in surface waters is now available from Hays Corp. Unit operates on the principle that the partial pressure of oxygen above a water surface is directly proportional to the amount of oxygen in solution at equilibrium.

Chelating Resin (44)

A new ion exchange resin that demonstrates high affinity for heavy metal cations—Dowex Chelating Resin A-1—is available from Dow Chemical Co. Dow reports that the resin will remove traces of copper, iron, or zinc from solutions of alkali or alkali earth metal salts. In addition, alkali earth cations can be removed from alkali metals. Resin can separate cobalt from nickel and copper from nickel.

Synthetic Flocculant (45)

Dow Chemical says that their latest in synthetic flocculants, Separan NP20, "is the most active material available on a unit weight basis". NP 20 is a white, flake solid, water-soluble and effective over a wide pH range.

Mining Lubricant (47)

Gulf Oil Corp. says that two separate field tests of Gulf Mining Lubricant H.D. prove that continuous mining machines operate longer between overhauls when this lubricant is used. H.D. is a semi-fluid multi-purpose grease that supplements Gulf Mining Lubricant B.

Hot Box Eliminator (48)

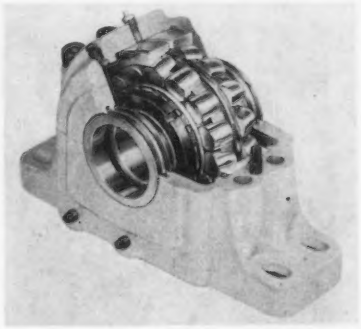
Pad-type lubricator developed for railroad car journals that is designed to hold up to 5.9 pints of oil, depending on the size of the car axle has been introduced by Magnus Metals Corp., subsidiary of National Lead Co.

High Speed Centrifuge (49)

Dorr-Oliver Inc.'s H-30 model Merco centrifuge will handle up to 600 gpm with substantial reductions in power requirements per gallon of slurry over earlier models of the Merco. One H-30 is being used to separate organic crystals from liquor at 90 degrees below zero.

Pump Motor (50)

Recent addition to Allis-Chalmers Mfg. Co. small motor line is the low voltage dc unit for pump drives and propulsion service. Motors are Class B insulation, either open or totally-enclosed non-ventilated. Temperature ratings based on 25 deg C ambient are 90 deg C for TENV and 75 deg C for open types. One through 8.8 hp sizes available for 12 (1 to 3 hp) or 36 volt service.



Spherical Roller Bearings (46)

Three major design improvements have been made in Link-Belt Co.'s self-aligning spherical roller bearings—maximum diameter and quantity of convex rollers for each bearing size; precision machined centrifugally-cast bronze retainers, and high, heavy inner race shoulders. Link-Belt says that two series are available in sizes ranging from 1.5748 to 11.0236 in. Bearings will also be available in pillow blocks in bore sizes from 1 7/16 to 10 in.

Refractory Brick (52)

Refractories Div., H. K. Porter Company, Inc. has announced a new Multex-85 chemically bonded high alumina brick specially designed for the aluminum industry. Molten aluminum will not penetrate. Silicon pickup is remarkably low. Tendency for drosses and fluxes to stick is reduced.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Mining

CATALOG of mine and industrial trackwork (470) lists rails, steel ties, turnouts, tire sets, crossings, switches and frogs. In addition, according to Bethlehem Steel Co., it contains many useful tables and instructions intended to save mine operators time. **(60)**

SHUTTLE CAR sales brochure from Goodman Manufacturing Co. lists data on the 36 to 48-in. high machines (G-139). 8pp. **(61)**

SLACKLINE CABLEWAY installation fitted with torque converter diesel is illustrated in Sauerman Bros., Inc. 12-page bulletin (TC-1). **(62)**

LATEST improvements in the Edison R-4 electric cap lamps are presented in a 4-page bulletin prepared by Mine Safety Appliances Co. (0201-5). **(63)**

HOW TO GET the most out of the shovel-cranes with torque converters is the title of an illustrated 12-page booklet (2740) prepared by Link-Belt Speeder Corp. **(64)**

NEED a 50-ton truck crane? The Construction Equipment Div., Baldwin-Lima-Hamilton Corp. has an 8-page catalog available that describes the Lima Type 64-T unit. **(65)**

NEED a 60-ton truck crane? Manitowoc Engineering Corp. has an 8-page illustrated bulletin (12-58) out on the Manitowoc Model 2900 unit. **(66)**

THREE-YARD tractor-shovel just recently added to the Trojan tractor-shovel line of Yale & Towne Mfg. Co. is illustrated in literature available on the Model 304 machine. **(67)**

EUCLID R-27, a 27-ton rear dump truck with 4-speed Torqmatic drive, converter lock-up, 325 or 335 hp and 18-yd struck capacity, is displayed in Euclid 16-page bulletin (130). **(68)**

MONEY SAVING HINTS on engine reconditioning is the subject of an 8-page bulletin (DE 864) printed by Caterpillar Tractor Co. **(69)**

AIR DUMP CARS designed by Magor Car Corp. are illustrated in a 6-page bulletin. **(70)**

HOW YOU CAN improve your company's competitive position through the use of Remington Rand Synchro-Tape (that makes it possible to get machine processing of records, orders and documents) is suggested in a 6-page bulletin. **(71)**

A RESPIRATOR designed with a single filter retainer cup for dust, mist, vapor, ammonia, fumes, acid gases and radioactive dusts is illustrated in a four-page bulletin published by Pulmosan Safety Equipment Corp. **(72)**

MOTOR and hand-operated hoists from Wright Hoist Div., American Chain & Cable Co., Inc. are presented in an 8-page bulletin (DH-28). **(73)**

VERTICAL PUMP MOTORS, rerated NEMA sizes, are now available from General Electric Co. in ratings from 7½ to 125 hp at 1800 rmp according to literature available. **(74)**

HIGH VOLTAGE CONTROLS in the Cutler-Hammer Inc. line are discussed in a 15-page booklet. **(75)**

BELT CONVEYOR IDLER bulletin (2716) produced by Link-Belt Co. contains details on five new series and 23 belt idler types for belt widths from 14 to 84 in. 40pp. **(76)**

FEATURES of Willson safety hats are described in a four-page bulletin that deals with the Geodetic suspension hats. Willson Products Division. **(77)**

PORTABLE SUBMERSIBLE electric pump, the Flygt B-50/200L, is illustrated in cutaway and described in a 6-page bulletin from the Stenberg Mfg. Corp. **(78)**

SINGLE-ACTING, non-return valves in the Golden-Anderson Cushioned valve line are detailed in an 8-page bulletin (S-2-B). **(79)**

VARIABLE-SPEED drives in the Reeves line of Reliance Electric & Engineering Co. line are discussed in an 8-page bulletin (G-5812). **(80)**

E&MJ NOT GOOD AFTER SEPT. 1, 1959

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. MARCH 1959

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
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16	32	48	64	80	96	112

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8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
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E&MJ NEW PRODUCTS DIGEST (*Continued*)

EQUIPMENT CLEANER featuring all electric design is introduced in Homestead Valve Mfg. Co.'s two-page flyer on Model E-350. **(81)**

FLOORING MATERIAL that will withstand up to 50% inorganic acid conditions without corroding has been developed by Stonhard Co., Inc. according to literature available. **(82)**

Metal & Mineral Processing

FLOTATION EQUIPMENT from Western Machinery Co. describes flotation process and the design and operating characteristics of the Wemco Fagergren machine. 8pp. **(83)**

THERMAL CONDUCTIVITY as a design tool is the feature in *Refractories* latest edition from Carborundum (Vol 3, No. 5). 8pp. **(84)**

ALAMINE 336, a symmetrical straight chain, saturated tertiary amine in which the alkyl groups are a C_8, C_{10} mixture, has shown exceptional characteristics as a liquid-ion exchange solvent according to literature available from General Mills, Inc. **(85)**

HIGH EFFICIENCY CYCLONE designed for fluid bed processes is presented in Ducon Co., Inc. 4-page bulletin (C-2058). **(86)**

TRICKLE VALVE for fluid bed applications is illustrated in a four-page bulletin (V01458) from Ducon Co., Inc. **(87)**

AUTOMATIC renewable-media air filter, the American Air Filter Co., Inc.'s Model B Roll-O-Matic, is presented in detail in an 8-page bulletin (248-C). **(88)**

ROTAMETER flow rate transmitters in the MPT line of Brooks Rotameter Co. are set forth in a 12-page bulletin (170). **(89)**

MANITOWOC AGITATOR is discussed in a 9-page bulletin prepared by Manitowoc Shipbuilding, Inc. **(90)**

FABRIC DUST COLLECTOR—the Dustube design of Wheelabrator Corp.—is presented in a 24-page illustrated applications bulletin (562-D). **(91)**

WHICH INCO nickel alloy can solve your wire cloth problem? is the title of a 15-page bulletin prepared by International Nickel Co. **(92)**

OXYGEN ANALYZER for the hospital or sick room is introduced in Beckman Scientific & Process Instrument Division literature (749). 2pp. **(93)**

CONTROLLED VOLUME Minipumps for metering chemicals in minute volumes against pressure (as little as 3 ml/hour with accuracy plus or minus 2%) are presented in Milton Roy bulletin (1257-1). 4pp. **(94)**

FILTERS for corrosives, but which also show promise in the field of flow control, gas diffusion and purification, are described in Corning Glass Works four-pages. **(95)**

SURGE RELIEF valves to protect against line overpressure are described in Golden Anderson Valve Specialty Co. bulletin (W-2-A). 8pp. **(96)**

CORROSIVE-RESISTANT coatings from Carboline Co. can be examined through a four-page bulletin (100) that contains a chart that details selection and mode of application. **(97)**

ADVANTAGES of aluminum in heat exchanger application are studied in Reynolds Metals Co.'s bulletin (732-1-1). 15pp. **(98)**

HIGH TEMPERATURE STEELS and alloy data card lists 19 special metals used in high temperature applications and all available from Allegheny Ludlum Steel Corp. File card size. **(99)**

PACKAGING METHODS brochure prepared by Colorado Fuel & Iron Corp. discusses the various Wickwire Spencer Steel Division products available for the job—reels, spiders, fiber drums, coils, steel strapped wooden racks, etc. **(100)**

CORROSION RESISTANCE of Haynes alloys is the title of a 39-page bulletin issued by Haynes Stellite Co. that lists penetration rates for the alloys in over 250 corrosives. **(101)**

CONTROL equipment catalog published by Energy Control Co., Inc. illustrates all the types of control equipment stocked. **(102)**

COMPRESSORS and gas turbines designed by Clark Bros. Co. are illustrated in 40-page catalog. Performance data and applications. **(103)**

WELDING DIRECTORY of manual electrodes for hardfacing, welding stainless and nonferrous as well as cast iron are set down in Lincoln Electric Co.'s 19-page catalog. **(104)**

DOWPAC applications in waste treatment is the title of a 32-page bulletin (171-113) on Dow Chemical Co.'s new plastic packing material used in the biological oxidation of liquid wastes. **(105)**

DESIGN FOR progress, a bulletin (G3-B50) prepared by Western-Knapp Engineering Co., tells about the men, the methods and the manner in which Western-Knapp designs and builds mineral processing plants. 32pp. **(106)**

Literature for Sale

MAINTENANCE HINTS handbook recently published by Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. contains 24 chapters, 650 pages and is 5x7 in. leatherette bound. Designed for general use on all types of electrical equipment. Available from Westinghouse, address above. Price $2.

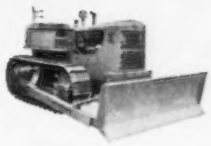
A-C ALLIS-CHALMERS

metal mining modernization

Allis-Chalmers wraps up your complete Processing Package

**Earth-moving machines,
processing machinery, electrical equipment
"Coordineered" from plan to plant**

HELP FOR YOU OR YOUR CONSULTANTS



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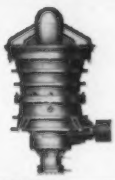

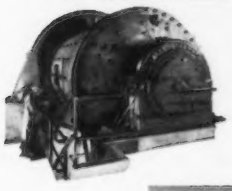

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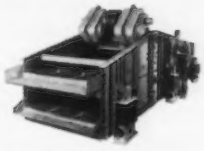

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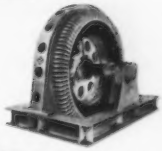


MAINTENANCE CHECKUPS, FAST PARTS SERVICE

Send for Bulletin 07B7995

Handy reference offers only scientific method of determining right crusher or grinding mill and required horsepower. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wis. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Que.

A-5932

Any way you look at it...

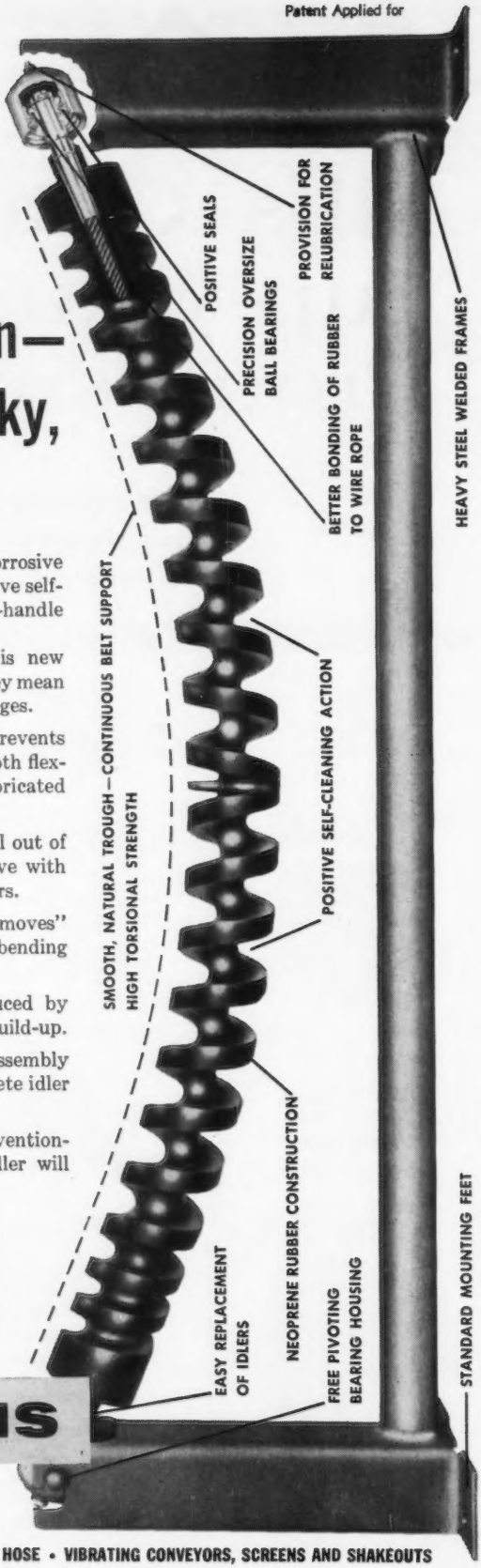
New Rubber Spiral Idler Defies Corrosion, Abrasion—Prevents Build-up of Sticky, Hard-to-Handle Materials

Here's the conveyor idler built to last longest in punishing corrosive atmosphere or extreme abrasive service! What's more, its exclusive self-cleaning rubber spiral prevents build-up of sticky, hard-to-handle materials!

The numerous design and construction advantages of this new Hewitt-Robins idler are shown in the illustration. Here's what they mean to you in terms of cost-cutting, time-saving, operating advantages.

- **LONG LIFE.** Neoprene spiral, completely covering wire rope, prevents attack in corrosive atmosphere. Uninterrupted spiral gives smooth flexing, maximum strength. Precision sealed bearings can be relubricated for still longer life.
- **SELF CLEANING.** As the spiral turns, it "works" any material out of the grooves as they change shape. This action is most effective with sticky materials which tend to build up on common types of idlers.
- **CONTINUOUS BELT SUPPORT.** The new rubber spiral design "moves" along the entire width of the belt; therefore, pinching and sharp bending of the belt are eliminated.
- **SELF TRAINING.** Belt training problems are greatly reduced by readily conforming rubber spiral, and by elimination of material build-up.
- **EASY REPLACEMENT.** The spiral, wire rope, and bearing assembly simply lifts out of its brackets—no tools are needed. The complete idler fits standard conveyor stringers.
- **TRUE OPERATING ECONOMY.** Under conditions where conventional idlers fail prematurely, the Hewitt-Robins rubber spiral idler will pay for itself many times over.

Deliveries of this revolutionary new idler are now being made in 18, 24, 30, and 36 inch belt sizes. In addition to the type shown, it is also furnished with a spreader frame for use in wire rope conveyor systems. For further information check your H-R distributor, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 3-16.



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THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...

CONVEYOR BELTING AND IDLERS • POWER TRANSMISSION DRIVES • INDUSTRIAL HOSE • VIBRATING CONVEYORS, SCREENS AND SHAKEOUTS

A-C ALLIS-CHALMERS

metal mining modernization

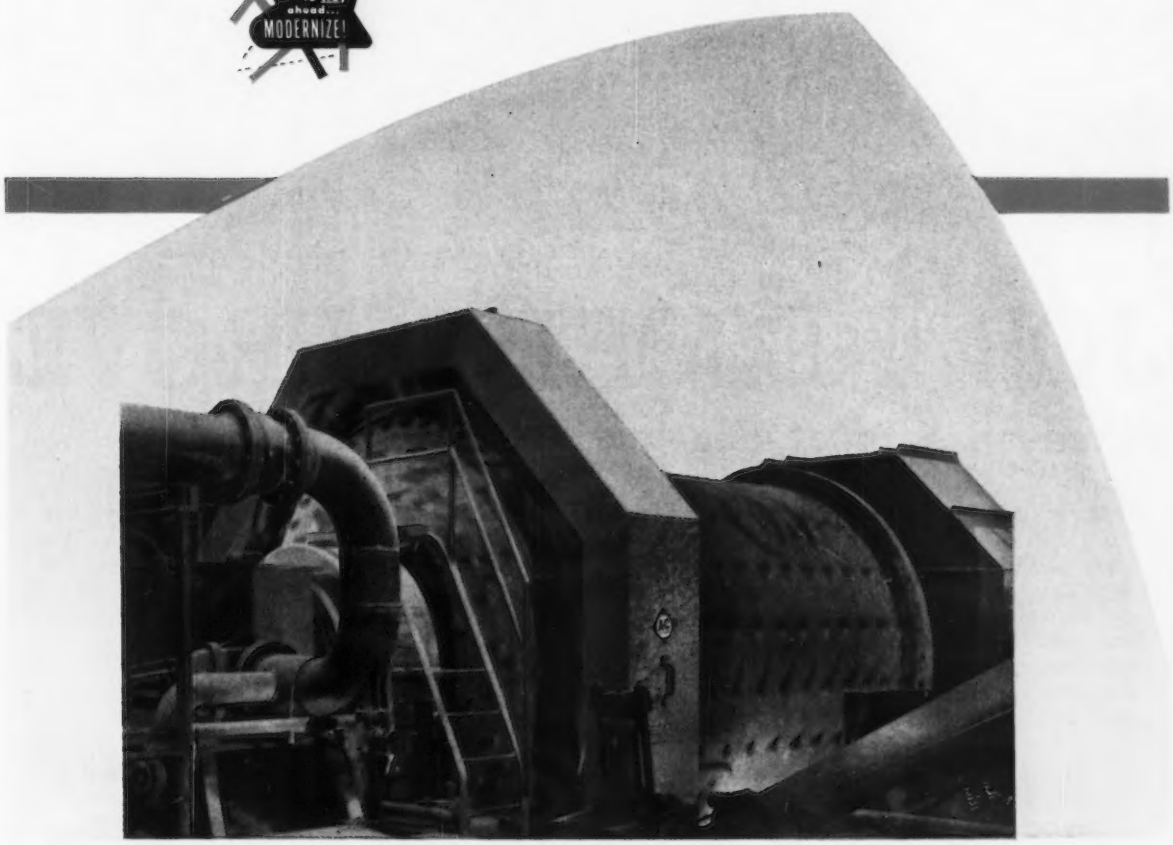
Grinding mills grow... Operating costs shrink

2000-hp mill does work of multiple units ...at far less cost

Plan to stay ahead... MODERNIZE!

It's the big mill that grinds out profits. Want proof? In a typical installation, a giant 13 by 20-ft, 2000-hp Allis-Chalmers mill replaced two 10½ by 17 units. Operating costs were cut by a whopping 25% without losing one ounce of capacity.

Grinding mills are on the grow. The single mill conserves floor space and affords better quality control with its improved circuits. Watch for the 2500 and 3000-hp Allis-Chalmers mills soon to be announced.



See your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

ALLIS-CHALMERS A-C

A-5936

A giant Eucnik in action—with a 120-ton haul capacity, the world's largest dump truck.

JOB RECORDS PROVE

Firestones lower heavyweight haul costs!

Firestone Off-The-Highway Tires deliver new lows in hourly costs on the roughest haulroads in the business! That's because every job-engineered Firestone is built with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires! Tough Firestone treads and sidewalls defy cuts in rubble and shale. Job-engineered tread designs give the traction you need for any footing. Exclusive Firestone S/F (Shock-Fortified) nylon bodies resist damage from bruising shock and impacts. Call your Firestone Dealer or Store and ask him about Firestone's full line of tubeless and tubed off-the-highway tires and on-the-job tire service. *Firestone T.M.

Firestone

BETTER RUBBER FROM START TO FINISH

Enjoy the Voice of Firestone on ABC television every Monday evening.

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When ordering new equipment always specify Firestone tires—available tubeless or tubed

Rock Grip* Excavator | Super Rock Grip Wide Base* | ANS Earthmover | Ground Grip* Wide Base | Super Ground Grip* Road Builder | Super Rock Grip Deep Tread | Super Mileage Lug Logger | Rib Excavator*

metal mining modernization

Synchronous motor control...

mill-matched to meet your requirements

Design of mill control requires knowledge of both motor and driven machine. Allis-Chalmers designs and builds both synchronous motors and grinding mills.

When you specify Allis-Chalmers control, you can be sure it is designed to reduce costly down time. Mill-matching is the answer to difficult starting, acceleration, synchronization, and motor protection problems.

For complete information, call your nearby A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

FEATURES

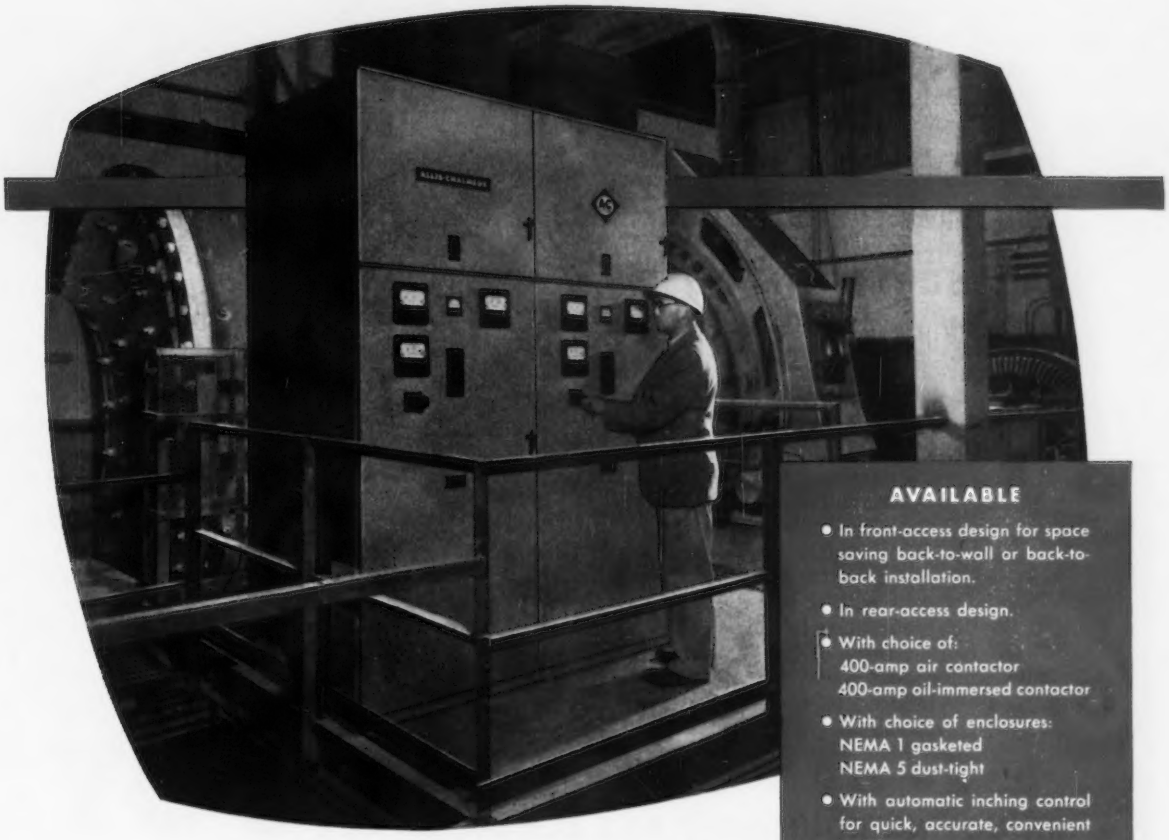
Current-limiting fuses clear short circuit in less than ½ cycle.

Polarized automatic field application and field-failure current relay provide complete field protection.

Temperature-compensated overload relay assures adequate stator protection.

Instantaneous or time-delay undervoltage protection available.

Synchronous motor controllers available in ratings to 1750 hp at 2400 volts, 3000 hp at 4800 volts.



AVAILABLE

- In front-access design for space saving back-to-wall or back-to-back installation.
- In rear-access design.
- With choice of:
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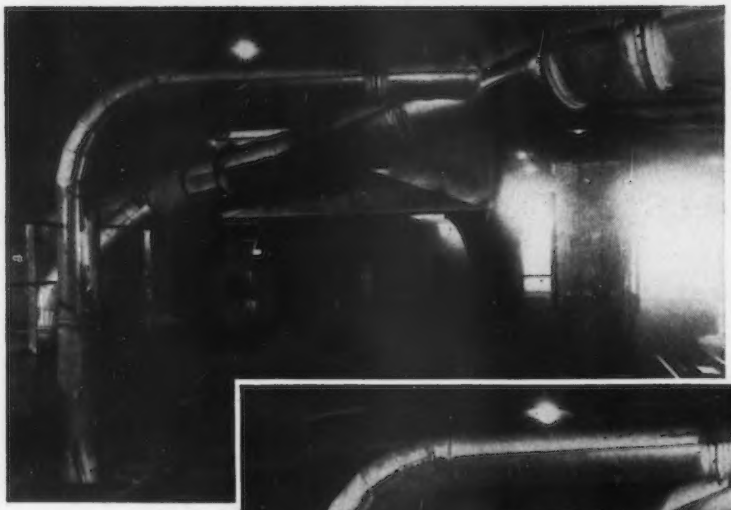
  400-amp oil-immersed contactor
- With choice of enclosures:
  NEMA 1 gasketed
  NEMA 5 dust-tight
- With automatic inching control for quick, accurate, convenient spotting.

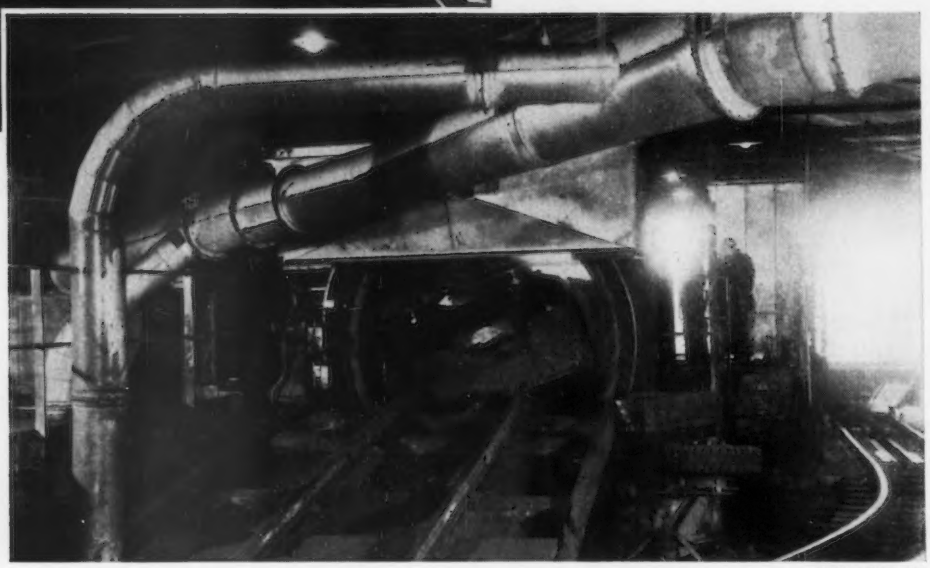
ALLIS-CHALMERS

A-5920



BEFORE: Inside the dump house before turning on the Joy Microdyne. Unretouched photo shows how dust laden air creates a choking haze.

AFTER: This unretouched photo shows dump house after the collector has been in operation for 15 minutes. The air has cleared, and dusts are carried through ducting to the Joy Microdyne.



WSW I 7431-284

JOY MICRODYNE DUST COLLECTOR GIVES CLEAN AIR... EVEN IN COAL DUMP

A large coal mine had a serious dust problem. Coal dust from a rotary car dump would fill the air in the building in which the equipment was housed. Over a period of two shifts, so much dust would settle that the conveyor equipment under the dump would clog with dust. A maintenance man would spend most of the third shift with shovel and broom to clear the accumulated dust.

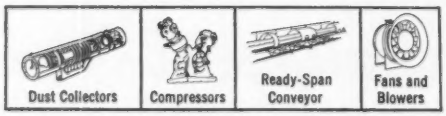
After a 32,000 cfm Joy Microdyne dust collector was installed, maintenance was reduced to a general once-a-week cleaning. By mounting the Microdyne halfway between the car dump and a large crusher house, and connecting them with stainless steel tubing, the one dust collector serves both buildings.

The Joy Microdyne is a new kind of dust collector, 1/10 to 1/20 the size of any other collector. It is extremely efficient and simple to install and is especially suited for conditions encountered in mining.

If *your* operation has a dust problem, why not talk to a Joy engineer.

Write for Bulletin 284-4

AIR MOVING EQUIPMENT FOR ALL INDUSTRY



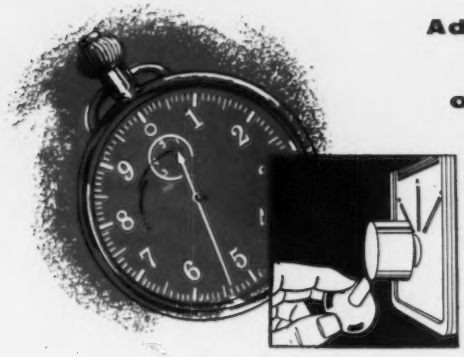
JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

A-C ALLIS-CHALMERS metal mining modernization

Savings by the second

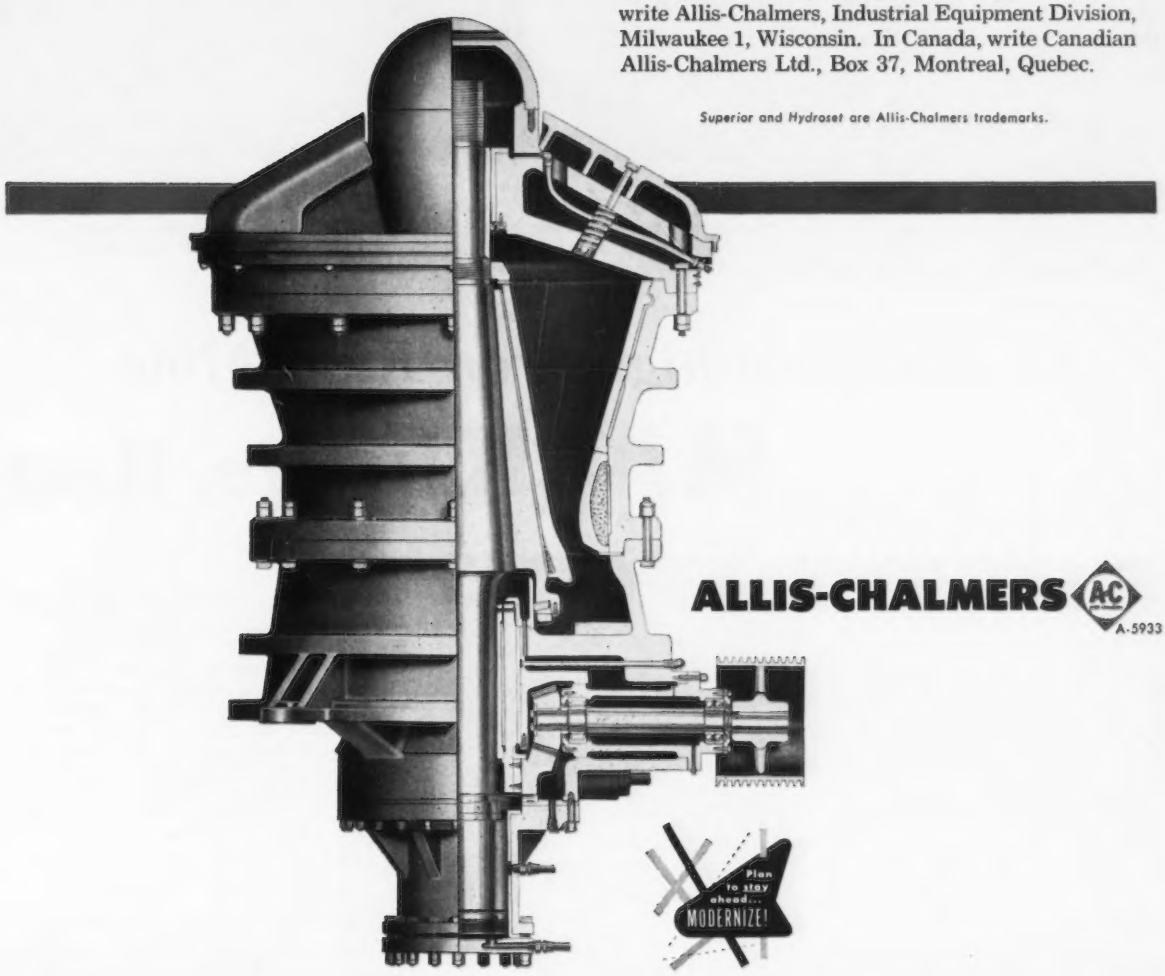


Adjusting for wear is a one-man, one-minute operation on Superior crushers

Even on the largest *Superior* crushers, the time it takes to change settings is measured with a stop watch — not a calendar. The secret is *Hydroset* control. Flip a switch, it's that easy. Remarkable *Hydroset* control also facilitates emergency unloading. Remember, only Allis-Chalmers gyratory crushers offer this profit-building speed and convenience.

Bulletin 07B7870 tells the complete *Superior* crusher story. Get a copy from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

Superior and *Hydroset* are Allis-Chalmers trademarks.



ALLIS-CHALMERS A-C

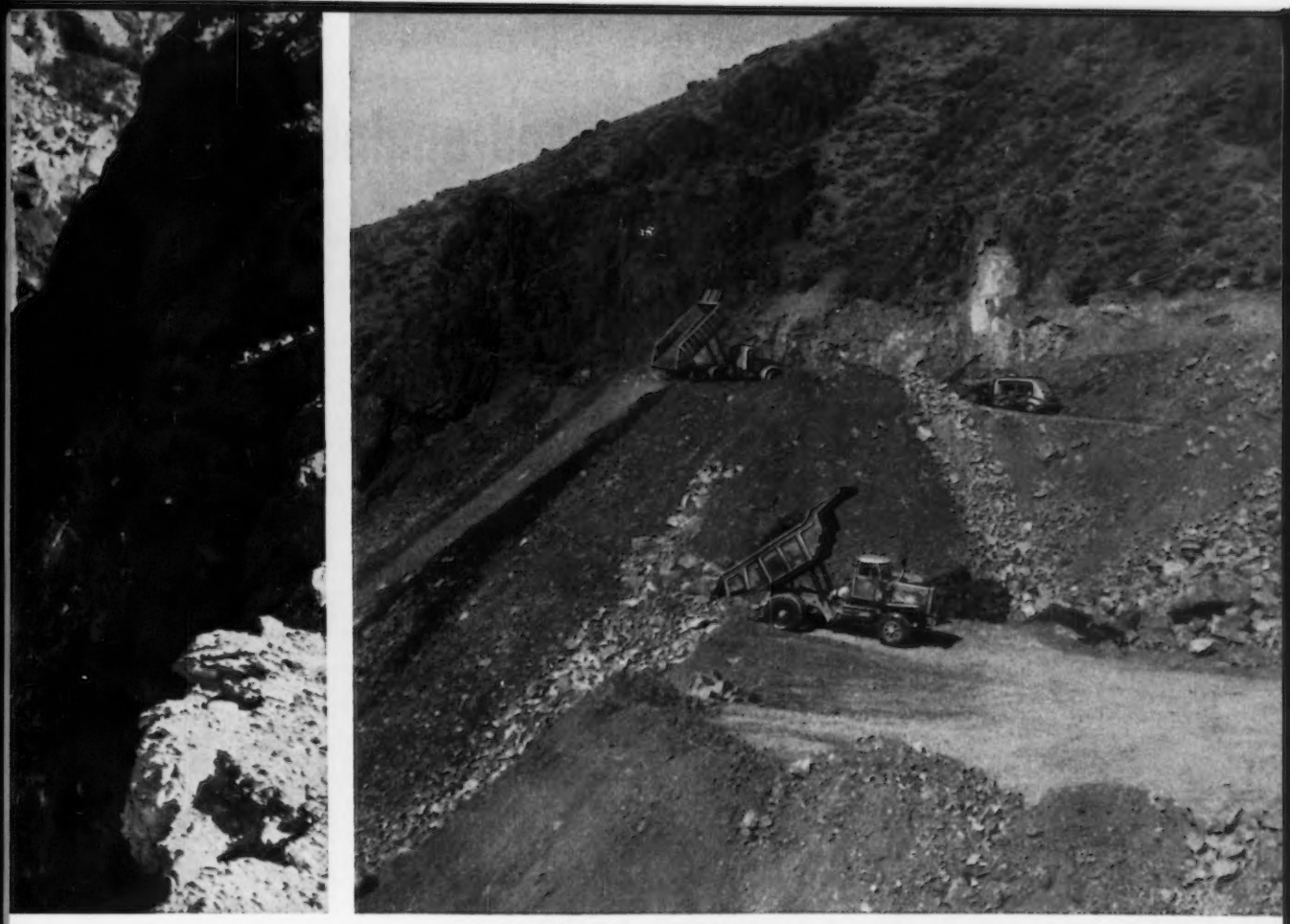
A-5933

FAST ACTION IN CLOSE QUARTERS—"Macks give us extra truck trips per shift," says Iron King Mine's W. G. Austin. That's because Mack-engineered steering systems cut cycle time with their sharp turning angles and smooth, rapid response. They enable fully loaded Macks to back rapidly into tight spots and to negotiate the hairpin turns of the steepest roadways. And Mack steering systems stay in line despite heavy cargoes, incessant loadings and axle-pounding roadways.

At mountain-high Iron King Mine

MACKS are first

WHERE YOU REALLY NEED THE BRAKES—Iron King Mine produces more than 100,000 tons annually of iron ore of high specific gravity—about the finest grade in the country. Seven Mack B-813S's, with 8-yard bodies, are used to carry the ore from the crusher to Jungo, Nevada—a 30-mile, downhill run. Relying on their big, powerful Mack-built brakes, the Macks make three to four round trips each per day. "This operation is economical from all standpoints," says the company. "Fuel consumption is low, and the Macks perform steadily, under all conditions, with minimum down time."



STAMINA FOR FAST LOADING - DUMPING CYCLES—Macks stand up to the most strenuous kind of service in the Iron King Mine operation. Dumping overburden, for example, means short, fast trips, with forty to fifty quick loadings per shift. Year after year, Mack frames, axles and suspensions are fully equal to the pressures and strains, require only routine attention.

choice for every rugged job

"We feel that our ore is hauled in the most efficient, economical way—from shovel to shipping point," says Mr. W. G. Austin, operator of the Iron King Mine, high in the Jackson Mountain Range of Nevada.

"To put it briefly—we use Macks. They give us the maneuverability and hauling power we need for working in steep, narrow, mountain canyons—so we use them for dumping overburden and for hustling the ore between the mine face and the crusher.

"They give us the kind of dependable operation we need for economical road hauling—so we use them to carry our crushed ore to the railroad, 30 miles away."

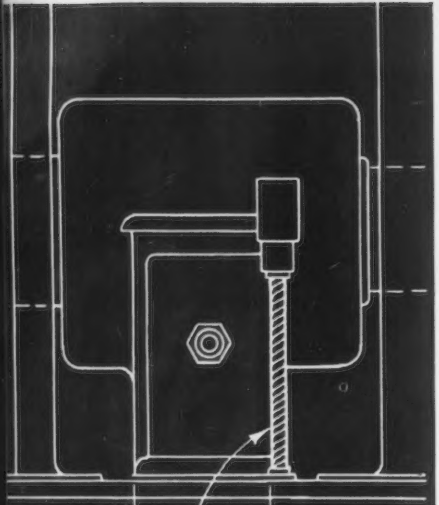
Mr. Austin bought his first Macks in 1955 and —because of their performance—he's been adding Macks ever since. Says Mr. Austin: "We now have a fleet of 13, and we're more than pleased with every one of them."

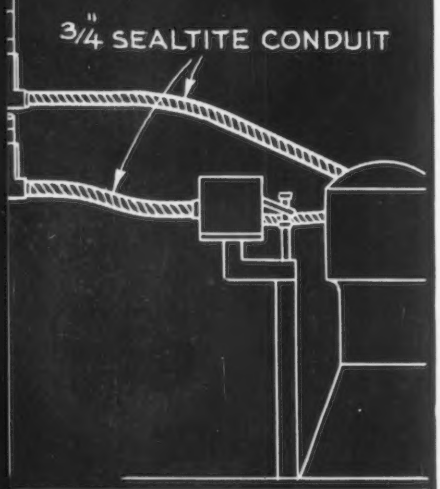
Why not check further? Ask your nearest Mack branch or distributor for the names of more Mack users who—like Iron King—had to be shown . . . and *were* shown. Mack Trucks, Inc., Plainfield, N. J. In Canada: Mack Trucks of Canada, Ltd.

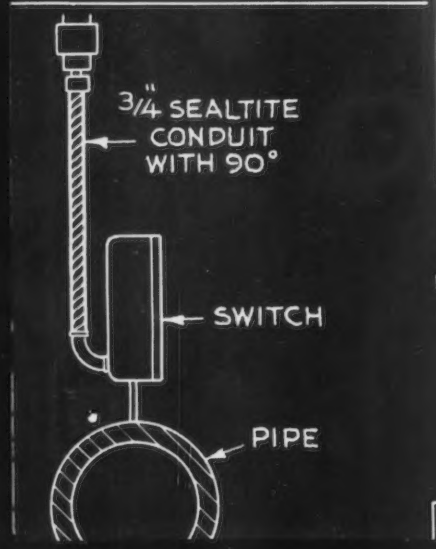
MACK
FIRST NAME FOR
TRUCKS

6516

3/4" SEALTITE







To carry good engineering over

SEALTITE COMES IN THREE TYPES:

TYPE U.A.— TYPE C.S.A. Specifications for Type U. A. (Underwriters' Laboratories Approved) and Type C. S. A. (Canadian Standards Association Approved). Construction: flexible galvanized steel core, positive ground and tough extruded outer cover.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.484	.504	.690	.710	6	30.0
1/2	.622	.642	.820	.840	7	36.6
3/4	.820	.840	1.030	1.050	10	48.2
1	1.041	1.066	1.290	1.315	12	87.7
1 1/4	1.380	1.410	1.630	1.660	15	116.5

TYPE E. F. * is extra flexible—for machine tools and industrial equipment. It meets J.I.C. requirements.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.485	.500	.695	.710	5	24
1/2	.620	.635	.825	.840	5	29
3/4	.815	.830	1.035	1.050	6	39
1	1.030	1.050	1.295	1.315	8	67
1 1/4	1.370	1.390	1.635	1.660	10	87
1 1/2	1.575	1.595	1.875	1.900	12	105
2	2.020	2.040	2.350	2.375	15	135
2 1/2	2.480	2.505	2.850	2.875	20	198
3	3.070	3.100	3.470	3.500	26	282
4	4.000	4.040	4.460	4.500	34	414

Commercial tolerances apply on above figures.

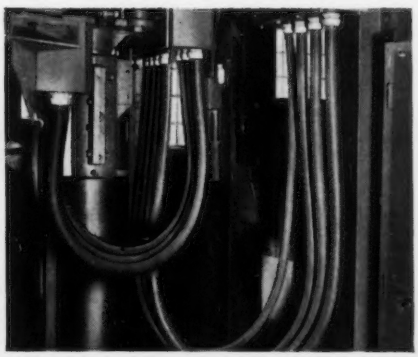
WHERE TO GET SEALTITE — Electrical Wholesalers stock Sealtite with gray or black cover in easy-to-handle cartons or on reels. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors.

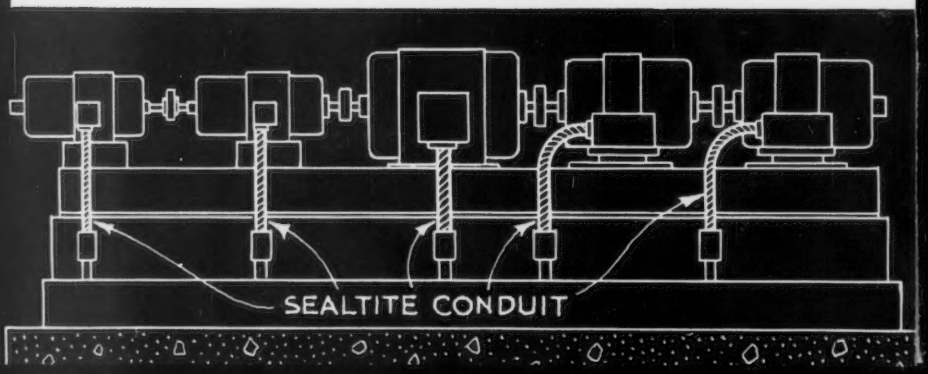
Free Booklet S-539 gives you full information on Sealtite. For your copy, write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada, Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont.

*Pat. Applied For 58184

FOR WET SPOTS

MOVING CONNECTIONS





from plans to performance insist on SEALTITE

the original flexible, liquid-tight electrical conduit that protects wiring against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather.

SEALTITE is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned outlets.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical plants and in many outdoor applications.

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible galvanized steel core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked

SEALTITE®

Flexible, Liquid-Tight Conduit

an* ANACONDA® *product

OUTDOORS

MISALIGNMENT

THIS IS

6583

THE IMAGE OF CF&I ...MAKER OF STEEL

He's a giant steelman. He makes good steel and steel products for the diversified needs of today's economy. He anticipates tomorrow's requirements. He is constantly improving products through research and new manufacturing techniques.

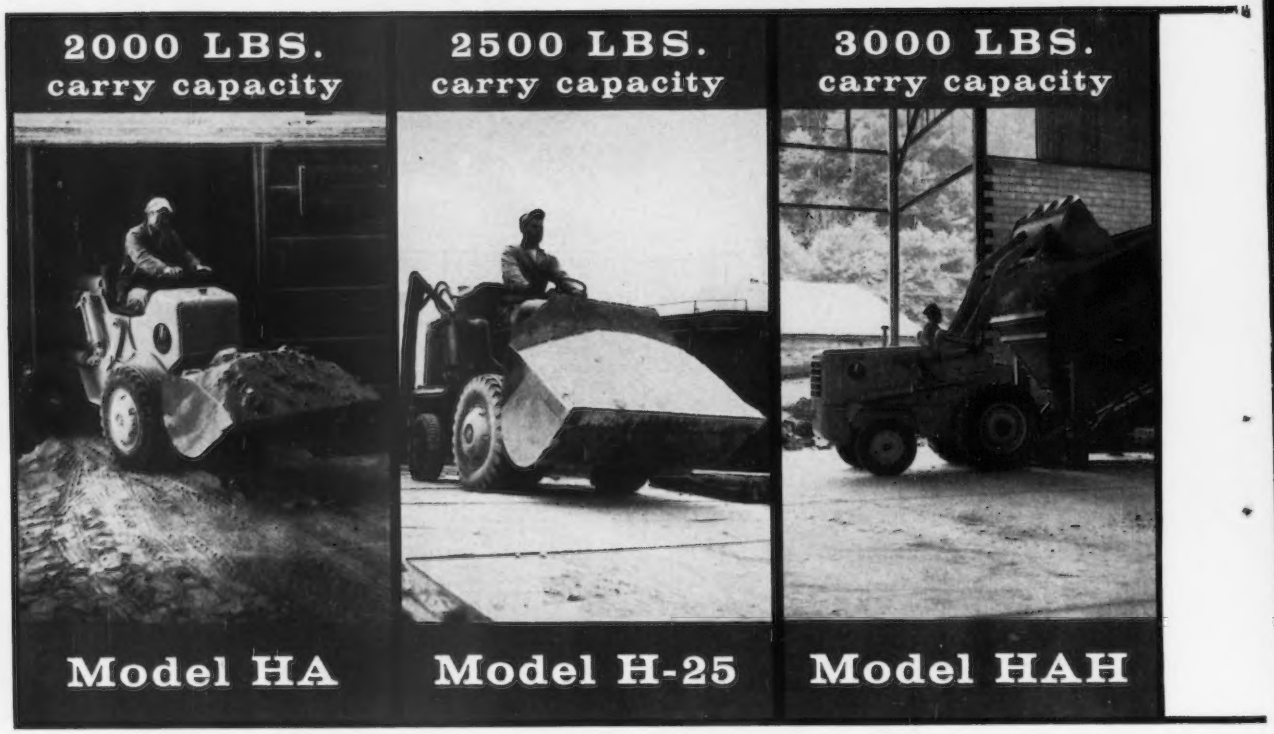
His steel mills extend across the country. In them, he guards every step of manufacturing by rigid quality controls. And in his national network of offices and warehouses, he not only *sells* steel products, but he *serves* their users in every possible way.

He is the dynamic image of CF&I . . . the symbol of dependable steel products. Look for him when you buy.

Plants at:
Pueblo, Colorado • Oakland and South San Francisco, California
Buffalo, New York • Claymont, Delaware • Palmer, Massachusetts
Birdsboro, Pennsylvania • Roebling, New Jersey • Trenton, New Jersey
40 Warehouses and 60 Sales offices located coast to coast

THE COLORADO FUEL AND IRON CORPORATION
DENVER • OAKLAND • NEW YORK

TWO-WHEEL DRIVE OR



PAYLOADER® is the

More "PAYLOADER" tractor-shovels have been built and sold than all other makes combined

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

ATTACHMENTS
for various "PAYLOADER" models

Drott 4-in-1 Bucket	Fork Lift
Vibratory Soil Compactor	Crane Hooks
Hydraulic Backhoe	Pick-Up Sweeper
Superior Side Boom	Payhopper Buckets
Blacktop Spreader	Snow Plow
Hydraulic Grapple Fork	Backfill Blade
	Hydraulic Winch

3-B-5

The "PAYLOADER" line of tractor-shovels offers the broadest selection of models and types in order that all kinds of jobs and materials can be handled with maximum efficiency and economy.

Because these jobs, materials, locations, lengths of haul, working areas and production requirements vary so greatly . . . the size, capacity and features of these tractor-shovels must vary in order to meet specific requirements.

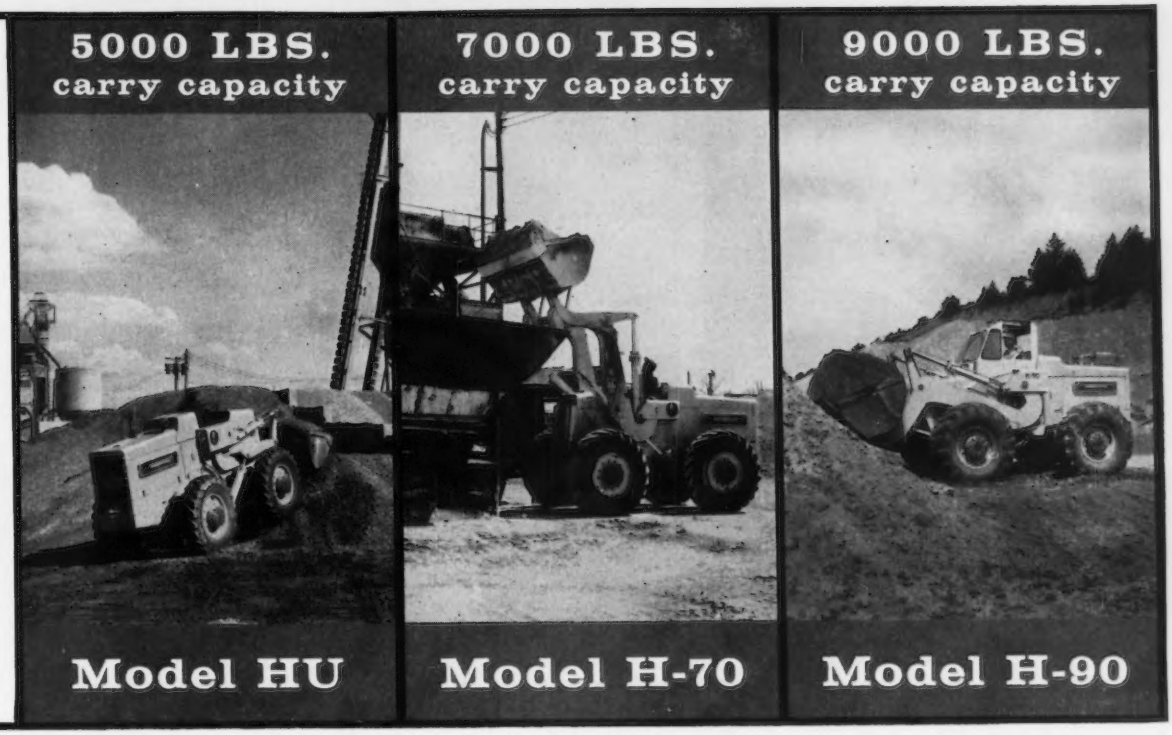
Two-wheel-drive "PAYLOADER" tractor-shovels are offered in three models with front-wheel-drive and one with rear-wheel-drive. These units have carry capacities up to 3,000 lbs., bucket tip-back of 40° at ground level enabling them to carry loads low and close to the machine for maximum stability and safety under all conditions.

They are compact and maneuverable for close-quarter operation indoors or outdoors. All of them have torque-converter drive and the model H-25 has a two-speed, power-shift transmission for the ultimate in ease of operation.

All of the two-wheel-drive models except the HA are equipped with power-transfer differentials which automatically provide more torque to the wheel with the best footing when slippery conditions are encountered. Gasoline or LPG power is available on all models; diesel power is available on both the HA and H-25 models.

The rear-wheel-drive model H-30R (not shown) has 3,000 lbs. carry capacity and in addition to stockpile work can be used for digging and excavating. A wider range of attachments is also available.

FOUR-WHEEL DRIVE . . .



standard of comparison

Three sizes of four-wheel-drive "PAYLOADER" tractor-shovels are available with either gas, diesel or L.P.G. power. All of these units have power-shift transmissions, power-transfer differentials, power-brakes and power-steering.

These rugged, heavy-duty loaders with large pneumatic tires and four-wheel-drive have the traction, flotation and power for large volume bulk material handling, excavating, stripping and grading on most any kind of footing. They can move from place to place with speed and mobility over paved or unpaved surfaces.

Tremendous breakout force and bucket tip-back at ground level enable these "PAYLOADER" models to get maximum loads, and keep them during travel. Exclusive "balanced-design" provides the utmost stability and underslung boom arms eliminate operator hazards during lifting and lowering movements.

The widest range of exclusive attachments and devices offered, make it possibe for these four-wheel-drive machines to handle many other jobs such as pipe laying, compacting, blacktop spreading, ditch digging, scraping, clamshell work, log and lumber handling, snow plowing and the like.

You get maximum efficiency when your equipment is matched to your job. You get maximum versatility when this equipment can be quickly converted to do numerous specialized operations.

It will pay you to consult your "PAYLOADER" Distributor regarding the productive capacities and most efficient use of the various models and attachments.

NEW LITERATURE

. . . is available without obligation showing the complete "PAYLOADER" tractor-shovel line and many of the useful attachments available for each model.

HOUGH®

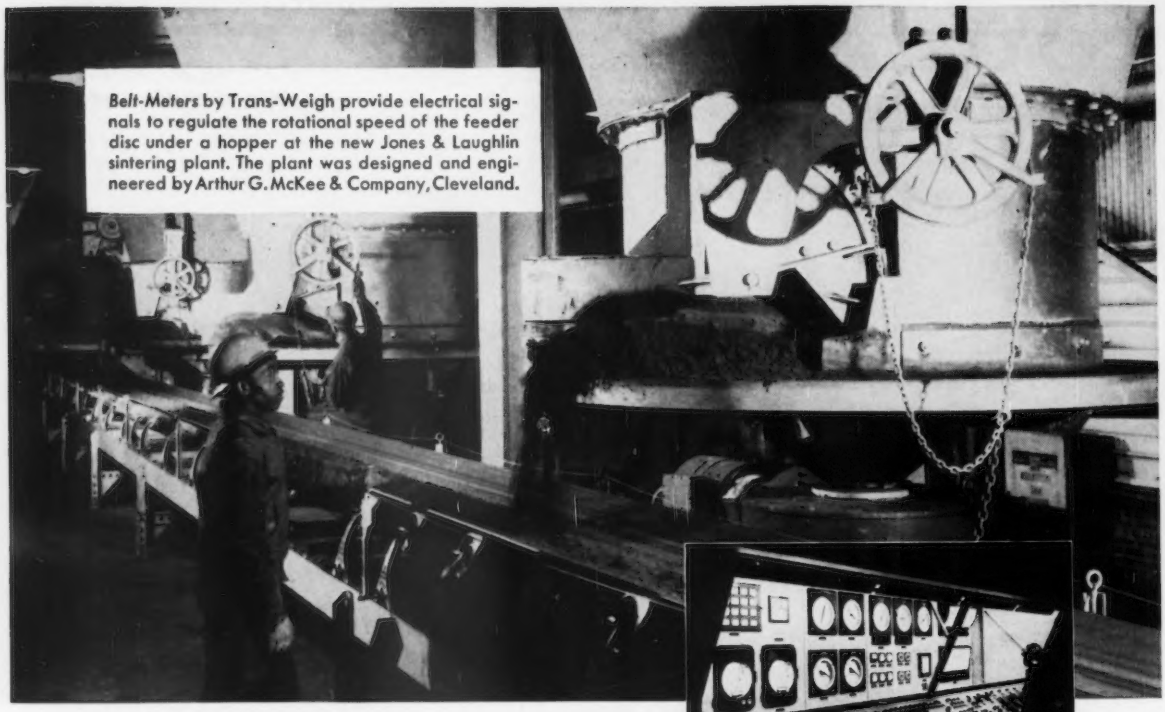
THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
726 Sunnyside Ave., Libertyville, Il.

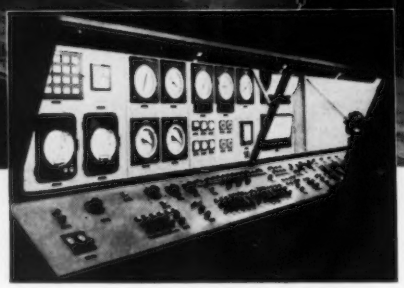
☐ Send "PAYLOADER" line literature
☐ Send information on Model _____

Name _____
Title _____
Company _____
Street _____
City _____
State _____

3-B-5



Belt-Meters by Trans-Weigh provide electrical signals to regulate the rotational speed of the feeder disc under a hopper at the new Jones & Laughlin sintering plant. The plant was designed and engineered by Arthur G. McKee & Company, Cleveland.



HONEYWELL INSTRUMENTS are pictured on the master weighing and proportioning control panel and console. Seven of the indicator-recorders shown here, and three behind the console, measure the weight of materials moving on belts—some of them transmitting signals for automatic control of materials flows. ▶

Sinter mix automatically weighed and proportioned at Jones & Laughlin plant

Honeywell *instruments control continuous process*

There's no time out for weighing materials at Jones & Laughlin Steel Corporation's 2,500 ton-per-day sintering plant in Cleveland. An automatic system weighs iron ore fines, coke breeze and flue dust, and feeds them in exactly right amounts to the sintering machine. The *Belt-Meter*® system, supplied by Trans-Weigh Company, King of Prussia, Pa., features a continuous electrical weighing technique and uses Honeywell instruments to control and proportion flow rates of materials as they move along a short section of belt.

The system consists of three main parts: (1) an electric tachometer to measure belt speed, (2) an electric strain gage load cell to measure belt load, and (3) an *ElectroniK* potentiometer to indicate and record flow of materials in tons per hour. In addition, a magnetic amplifier controls flows from table feeders. Twelve automated weighing units check materials as they move through every important phase of the sintering process. Operators can vary ratios and switch to manual control when desired.

You'll find Honeywell instruments controlling virtually *every* type of process in the modern steel mill . . . improving productivity, keeping quality standards high, and bringing important day-to-day economies. Your nearby Honeywell field engineer can help you gain these advantages in your own plant. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control*

You can keep all your equipment on the job with only 6 Texaco Lubricants

Modern mining equipment embodies a multitude of complex parts. But you don't have to have a multitude of oils and greases to keep it running. With a Texaco Simplified Lubrication Plan—tailored to your exact needs—you can do the job with as few as 6 lubricants.

Think what that means in terms of:

Smaller lubricant inventory

Reduced chance of application error

Insurance of longer periods of uninterrupted production

Lower maintenance costs

Planned lubrication schedules in every Texaco Simplified Lubrication Plan make good maintenance practice easy and certain. And equipment lasts longer because top grade lubricants lengthen its life.

Hydraulic systems, for example, are charged with Texaco Regal Oil R&O. This premium hydraulic oil is far more than a physical medium for transmitting power. It also lubricates pumps, cylinders and other system components. Texaco Regal Oil R&O contains special additives that assure resistance to oxidation, sludging and foaming, and prevent wear and rust—the best guarantee you can get for precise control and longer uninterrupted operation.

Find out exactly how a few Texaco lubricants can keep all your equipment running efficiently. Call the nearest of more than 2,000 Texaco Distributing Plants in all States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

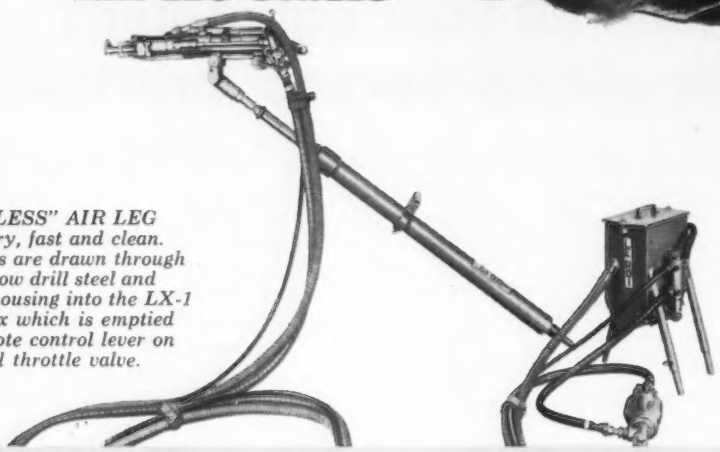
TUNE IN . . . Metropolitan Opera Radio Broadcasts Saturday Afternoons—CBS

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

NO STUCK STEELS

WITH THE NEW LE ROI DUSTLESS AIR LEG DRILLS



NEW "DUSTLESS" AIR LEG drills dry, fast and clean. Cuttings are drawn through the hollow drill steel and chuck housing into the LX-1 dust box which is emptied by remote control lever on the drill throttle valve.

Steels never stick when they're on the business end of the *new* Le Roi LLV Dust-Collecting Air Leg Drill. The dustless drill melts its way through the hardest rock — piles up more drilling footage with a lower dust count than was ever possible with wet drilling.

Dry, dustless drilling permits continuous ore sampling — saves every speck of precious ore. It eliminates the need and expense of water — does away with wet, dangerous conditions; sinking pillars; lost holes; water and muck haulage.

The LLV collects dust through the drill steel and exhausts it through the chuck housing — *not the machine!* It's ideal for mining or tunneling in hard rock — saves tools and operators.

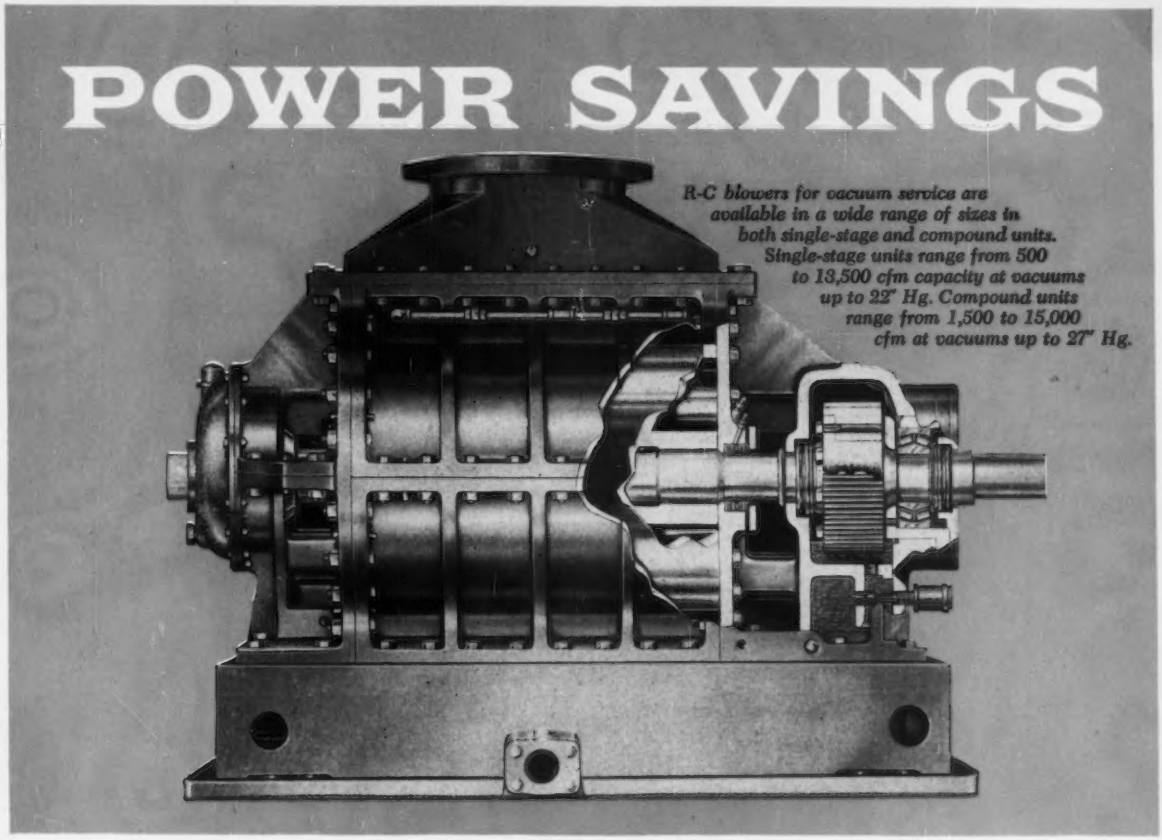
Ask your Le Roi distributor for a demonstration. Or for more information, write to the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wis.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-907

POWER SAVINGS



R-C blowers for vacuum service are available in a wide range of sizes in both single-stage and compound units. Single-stage units range from 500 to 13,500 cfm capacity at vacuums up to 22" Hg. Compound units range from 1,500 to 15,000 cfm at vacuums up to 27" Hg.

...up to 25% with R-C Cycloidal Blowers for Vacuum Service

Because R-C cycloidal blowers for vacuum service operate at higher speeds with reduced horsepower, power savings of as much as 25% are often possible. Their simple design and rugged construction assure superior performance, low maintenance and long life. These advantages derive from the high volumetric efficiency of the design, low mechanical friction and installation flexibility. Minimum sealing water effectively overcomes slippage loss . . . as little as 4 gpm may be required.

R-C blowers for vacuum service are used throughout the world in a large number of industries. In chemical processing, R-C blowers have many applications in the handling of nitrogen, hydrogen, acetylene, moist air with SO^2, and other oil and gas mixtures. In paper-making, R-C blowers supply vacuum for suction rolls. In mining, R-C blowers provide vacuum for flotation, filtration and other ore processing requirements. And throughout general industry, they are used for carburetor testing, pneumatic conveying, food processing, cigarette tipping machines, aircraft component testing and many other applications.

Only Roots-Connersville vacuum equipment offers so many advantages — exclusive rotary positive design, ease of installation, efficiency of operation, and long years of trouble-free service. These features are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.

For additional data, please refer to pages 565-568 in **CHEMICAL ENGINEERING CATALOG,** *our section in* **MECHANICAL CATALOG** *or write for* **Bulletin VP-158.**

ROOTS-CONNERSVILLE BLOWER
DIVISION OF DRESSER INDUSTRIES, INC.
359 Washington Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto

Okocord Red Saddle twin Type W cable in action on loader and shuttle car at Intermountain Chemical Company's trona mine. Secret of Red Saddle's added strength and security against short circuits is the pre-formed, red neoprene protective wall between the conductors, and the compact construction in which all components are locked together for maximum ruggedness.

They've cut mining costs with tougher cables

"We've found that the longer life of Okocord cables means lower operating costs for us," says Jack Wilson, Maintenance Supervisor for Intermountain Chemical Company of Westvaco, Wyoming. "Our mining operation is almost 100% electrified. We need cables that can stand up to extreme abuse. Okocord mining cables have everything it takes to prevent work stoppages that waste man hours or immobilize expensive equipment." They're tough, highly flexible, and unaffected by oils, acids, alkalies or mine water.

On its shuttle cars—key to continuous, efficient operation—Intermountain finds that Okocord Red Saddle twin cable stands up best to high-speed reeling and unreeling . . . to being stretched tight against sharp tunnel wall corners . . . to frequent cable runovers . . . and to pulling and stretching. Says Mr. Wilson: "Okocord Red Saddle shuttle car cable minimizes internal shorts due to cable abuse."

There are Okocord quality cables to keep *your* mining equipment operating efficiently: shovels, drills, cutting equipment and other machinery. There are Okonite specialists ready and willing to help you in planning new cable systems. And there is an illustrated, 76-page booklet on mining cables that's free when you write for Bulletin EM-450, The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

6218

Now...a JOHN DEERE *DIESEL* Crawler-Loader *to Cut Your Costs*

This 2-cycle, 2-cylinder Diesel has a rated horsepower of 33-1/4 at 1850 rpm, develops maximum torque of 108 lb. ft. at 800 rpm.

It's the job-proved John Deere "440," now available with a husky, high-torque Diesel engine! It not only provides a new measure of smooth, rapid response, but delivers 10 per cent more power than previous crawler-loaders in the line. And, the "440's" optional clutch-type direction reverser makes it possible to take full advantage of this new power in loading, earth moving, and other materials-handling jobs.

There's more than new power behind this cost-cutting loader. Advanced engineering puts the bucket's exceptional breakout capacity under greatly simplified control. When bucket is dumped from full-height position, it returns to the ideal 9-degree digging angle by use ot the boom control only.

For details, send coupon today. For a demonstration on your job, see your John Deere industrial dealer, now!

LOADS EVEN THE LARGEST TRUCKS

7/8-yard bucket has a dumping clearance of 7 feet 10 inches.

NEW PRY-OUT BOOSTS WORK OUTPUT

35-degree bucket roll-back with 8,500 pounds pry-out action.

ROLL-BACK LINKAGE SPEEDS WORK

When the bucket is used at 65-degree grading angle, for bulldozing and back-filling, it is only necessary to operate the boom-control lever to raise and dump the bucket.

TWO NEW JOHN DEERE BACKHOES!

Choose the center-mounted 50 or, for flush digging, the five-position 51. Each features two-lever control, plus great new pry-out power.

JOHN DEERE
Industrial
Tractors and Equipment

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JOHN DEERE INDUSTRIAL DIVISION
Moline, Ill. • DEPT. D-70-E

Please send literature on the John Deere "440" Crawler with 831 Loader: ☐ Gasoline ☐ Diesel.

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Mining phosphate — After stripping overburden from a deep vein, a Koehring® 605 dragline (left) loaded phosphate out of the narrow cut. On this type of operation, the big 605 can be used with 50 to 110 feet of boom — and handles 1½ to 2½-cu. yd. dragline bucket, depending on weight of materials. (Check its other work capacities in chart on the next page.)

Heavy-duty 2-yard — Here is another Koehring size worth looking into — the 2-yard 805, with 25-foot deep-section shovel boom and 18½-foot dual dipper sticks. Fully convertible to clamshell for stockpiling, or dragline for stripping — handles 2 to 3-yard buckets on 50 to 150-foot boom. The 805 does your heavy lifting, too — safely handles loads up to 52 tons!

Introducing . . . the new 435

Now, Koehring brings you 35 tons of lift capacity, plus high-speed mobility on rubber, for lifting, material-handling, general utility and maintenance work around mines, quarries. It's the new 435 truck crane (shown above). Big, rugged — yet, is quickly convertible from fully-equipped crane to roadable machine for highway travel.

Quick facts on KOEHRING WORK CAPACITY:

	MODEL	TYPE OF MOUNTING	CRANE LIFT CAPACITIES (Rubber-tired machines rated at 85% of tipping load.)	
ON RUBBER	205	3-axle truck, or 21.5 mph Cruiser	30,000 lbs.	at 12-ft. radius
	305	3-axle truck, or 18 mph Cruiser	50,000 lbs.	at 12-ft. radius
	330	3-axle truck	60,000 lbs.	at 15-ft. radius
	435	4-axle truck	70,000 lbs.	at 15-ft. radius
	545	4-axle truck	90,000 lbs.	at 15-ft. radius
		Size shovel	CRANE LIFT CAPACITIES (Crawler ratings based on 75% of tipping load.)	
ON CRAWLERS	205	½ Cu. Yd.	20,000 lbs.	at 10-ft. radius
	305	¾ Cu. Yd.	30,000 lbs.	at 12-ft. radius
	405	1 Cu. Yd.	40,000 lbs.	at 12-ft. radius
	545	(Crane only — 85% rating)	90,000 lbs.	at 12-ft. radius
	605	1½ Cu. Yds.	72,300 lbs.	at 12-ft. radius
	805	2 Cu. Yds.	104,200 lbs.	at 12-ft. radius
	1205	3 Cu. Yds.	190,000 lbs.	at 12-ft. radius

Dumping height: 40 feet-10 in. —

Owner of this strip mine needed a long-reach shovel — brought in a Koehring high-lift 1205, equipped with 2½-yard dipper on *50-foot* boom. Working with boom at 45° angle, it has a cutting height of 51 feet-4 inches — and dumps at heights up to 40 feet-10 inches. This big 1205 is also available with *3-yard* dipper on 40-foot high-lift boom — or as a standard 3-yard with 30-foot shovel boom for toughest digging. Its power, strength and load-stability as a shovel pay off in *extra work capacity* with all attachments. Takes 3 to 4-yard dragline or clamshell buckets on 60 to 170-foot boom—has 95-ton capacity as a lift crane (based on 75% rating). Koehring distributor has complete details on this, and other sizes. Call him today.

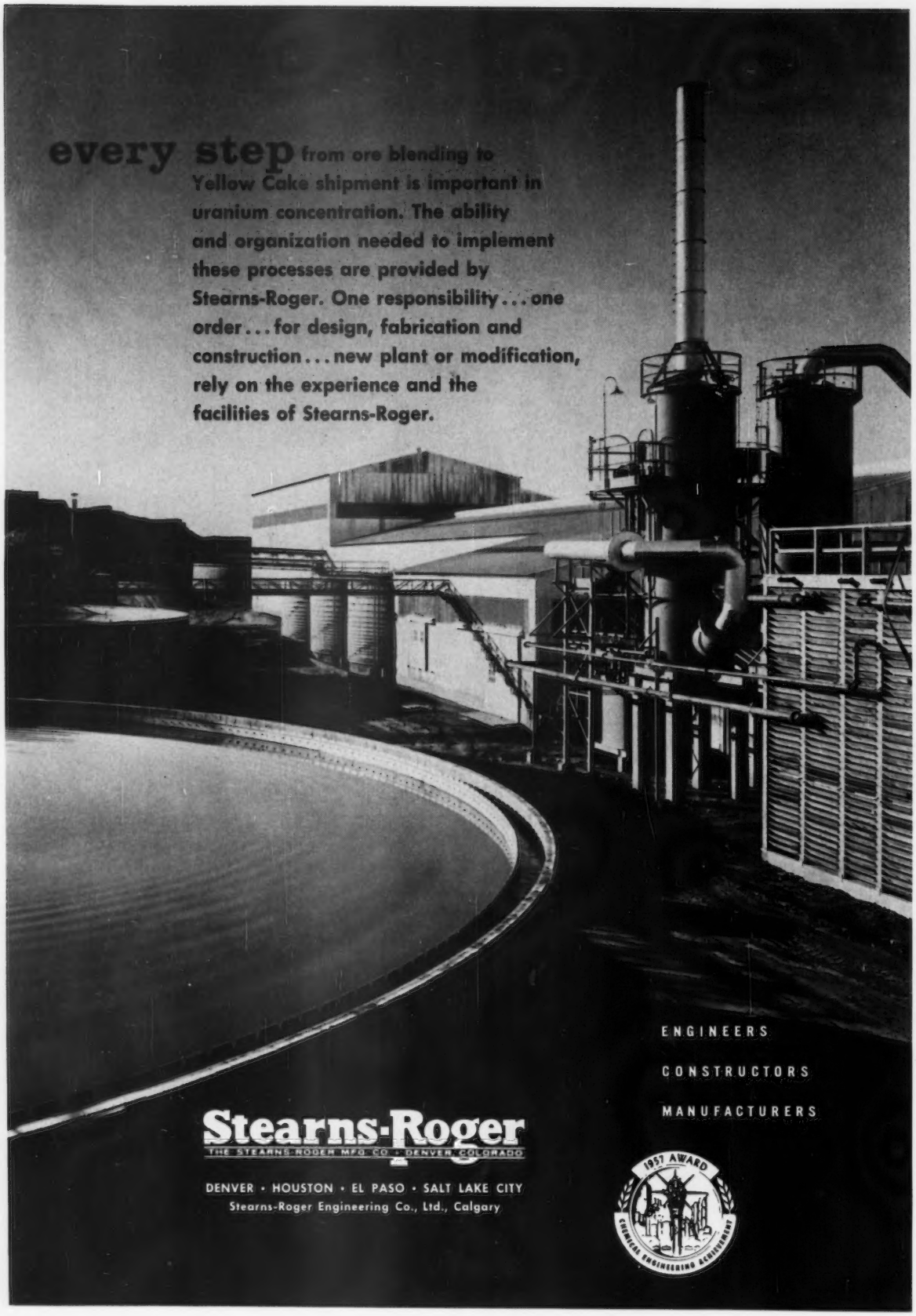
KOEHRING

DIVISION OF KOEHRING CO.

Milwaukee 16, Wisconsin

Koehring excavators and cranes also manufactured in:

CANADA • ENGLAND • SPAIN • JAPAN K912


every step from ore blending to Yellow Cake shipment is important in uranium concentration. The ability and organization needed to implement these processes are provided by Stearns-Roger. One responsibility... one order... for design, fabrication and construction... new plant or modification, rely on the experience and the facilities of Stearns-Roger.
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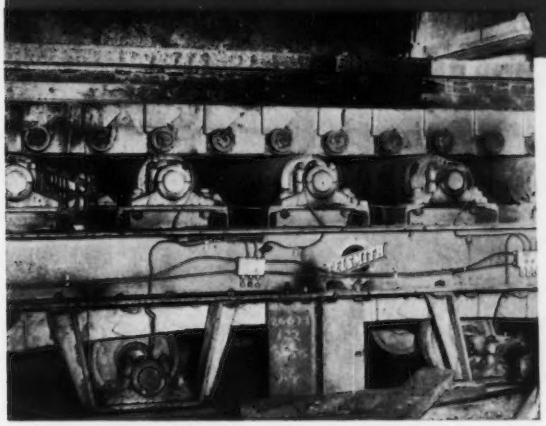
CHEMICAL ENGINEERING ACHIEVEMENT

TELSMITH®

more economical feeders



CLEVELAND-CLIFFS IRON CO., Negaunee, Michigan has a 48-inch wide x 14-foot long Telsmith Heavy-Duty Apron Feeder with manganese steel flights, feeding a 25 x 36 Telsmith Roller Bearing Jaw Crusher. Capacity is about 3000 tons per day.

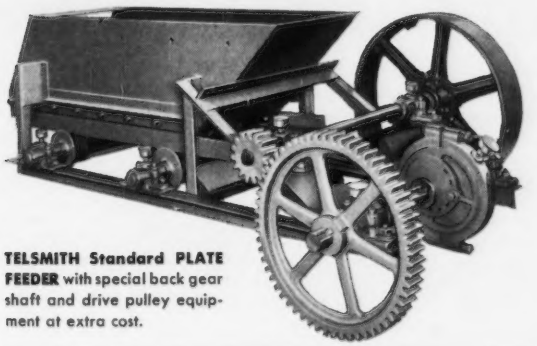
● Keep your conveyors, screens and crushers working smoothly and at full capacity. Telsmith Apron or Plate Feeders insure steady, uniformly regulated flow of material to entire plant—boost your output and cut cost of up-keep.

APRON FEEDERS are self-contained units on heavy structural steel frames. **Heavy-Duty Apron Feeders** —with carbon, or manganese steel flights—handle the toughest jobs, such as feeding primary crushers, either jaw or gyratory. **Standard-Duty Apron Feeders** —equally sturdy, but weigh less. Apron Feeders are made in 24-in. to 72-in. widths, with capacities from 25 to 800 tons per hour. Furnished with heavy steel hoppers, at extra cost.

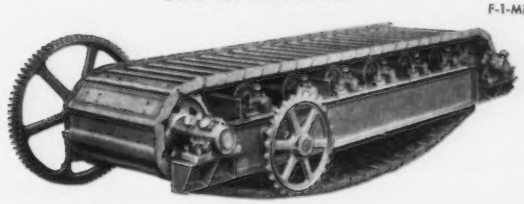
PLATE FEEDERS are simple in design—sturdy in construction. Adjustable stroke regulates capacity. Made in both Standard and Heavy-Duty models; widths 16-in. to 60-in.; capacities 12 to 740 cu. yds. per hr.

Send for Bulletin 266

F-1-Min.



TELSMITH Standard PLATE FEEDER with special back gear shaft and drive pulley equipment at extra cost.



TELSMITH Standard-Duty APRON FEEDER—Raised edges of its ⅜-in. steel flights prevent spillage.

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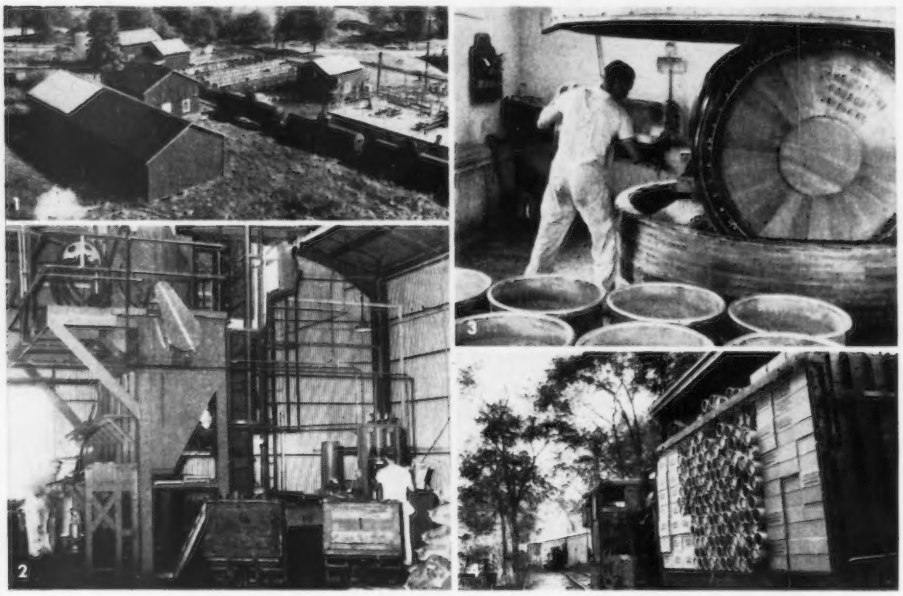
CYANAMID

Explosives News

CYANAMID'S NEW CASTLE EXPLOSIVES PLANT INCREASES MANUFACTURING CAPACITY

In construction, mining and quarrying, the increased need for high quality industrial explosives continues to grow. To meet this demand, Cyanamid has recently completed a building and expansion program that includes a new ammonium nitrate plant, as well as many new types of equipment, processes and other facilities.
Shown here are a few photographs of the mighty 535-acre New Castle explosive manufacturing operations.



1. One end of the tank battery, the refrigeration plant and storage facilities for glycerine and glycol. Partly hidden by trees (left center) is the gelatin line warehouse and gelatin line dope house.
2. The blasting agents building, where work is being done with an insensitive explosive. To detonate this mixture, a large priming charge of high explosives is required.
3. One of the large wooden chaser-mill type mixers in the dynamite mix house. Here nitroglycerin and nitrocotton are mixed with the "dope" as it comes from the dope house for processing. After mixing, the explosive has been formed. As dynamite, it is taken by tram line to the pack houses.
4. Here packaged explosives are shown on their way by tram to the storage magazine.

Cyanamid customers can be assured of highest quality and unequalled nationwide service now and in the future.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Photo Number 2 by Jack Simon, New Castle (Pa.) News

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Pottsville, Pennsylvania
Dallas, Texas
Salt Lake City, Utah
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PLANTS:

Grafton, Illinois
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High Explosives
Permissibles
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Blasting Powder
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Electric Blasting Caps
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Cyanidation Process Chemicals
Flotation Reagents
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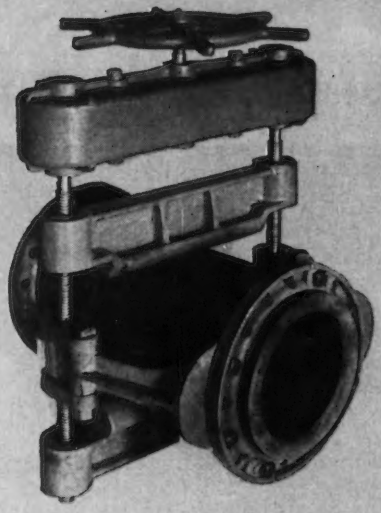


ECONOMIZE

with built-in REOPCO*

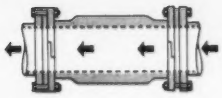
Massco-Grigsby Pinch Valves

...their Long Wearing Life makes them

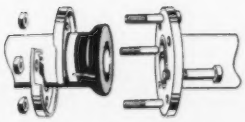
Cost Less to Own!

- **Rubber or Neoprene sleeves for abrasive and corrosive pulps and liquids**
- **1" to 14" inside diameter**
- **Pressures to 150 psi.**
- **Temperatures to 200° F.**
- **Manual or power-operated closing mechanisms**
- **Automatic regulation and remote control available.**

Patented "hinged" sleeve. Recesses serve as "hinges" during compression; reduce strain and permit tight closing.



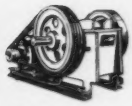
Unobstructed flow eliminates high friction loss.



Split flanges and Flex Seal ends assure perfect seal.

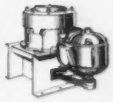
*Reduced operating costs.

and Laboratory Equipment, too



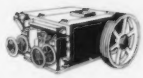
4" x 6" Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.



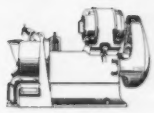
6" and 10" Massco Gy-Roll Reduction Laboratory Crusher

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.



Laboratory Crushing Rolls

Sizes (Diameter x width): 8" x 4", 10"x 6", 10"x 8", 12"x 10" and 12" x 12". Adjustable roll space setting up to ¾". Double V-belt drive. Heavy, cast Meehanite frame absorbs vibration, results in long life.



Massco-McCool Pulverizers

Disc type grinder with a planetary movement. No gears. Will grind to 150 mesh in one pass.

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Manufacturing Division

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Photo Number 2 by Jack Simon, New Castle (Pa.) News

Heavy Construction Operators

GO FORD-WARD for greater payload... power..

"Our Ford trucks haul up to a ton-and-a-half more payload per trip"

says William R. Collins, V.P.
William Collins and Sons, Fargo, N.D.

"We switched to Ford trucks in 1951 because we found we could haul 1½ tons more per trip. Now we have 124 Fords, including 80 T-700's. They're economical to operate, too—we get up to 6 miles per gallon. Our drivers like Ford's power steering and peppy 302 HD V-8 engine. We like Fords because we know we can always get Ford parts quickly if we need them. That means our trucks aren't down over one day, even on a major overhaul."

"We trade every two years and find that Ford trucks bring highest resale price"

says John McCormick, Sec.-Treas.
Northern Improvement Co., Fargo, N.D.

"We keep our Ford T-700's in top condition year round, and it pays off. We get a higher resale price when we trade every two years. Fords have the ability to perform under the rugged conditions in our work. Power steering on our tandem dumps makes them easy to handle on-or off-the road.

"Our drivers like Ford's power . . . they get heavy loads under way fast"

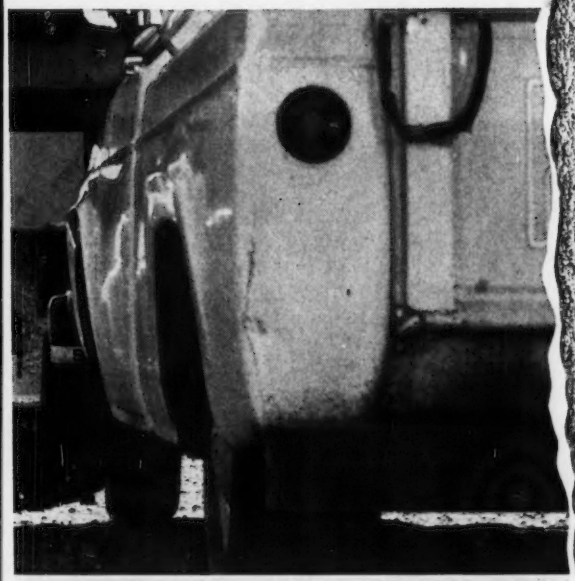
says George C. Wilson, General Superintendent
Schultz and Lindsay Construction Co., Fargo, N. D.

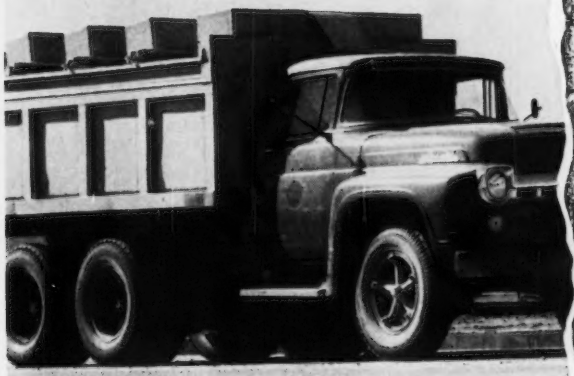
"Ford's HD power in our T-750's gets heavy loads under way fast . . . helps keep us on schedule. And we can haul bigger payloads doing it . . . up to a yard more, legally, every trip. We've never had frame trouble either. They're rugged, durable trucks and if we ever need Ford parts, we can always get them at the nearest town."

FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN... LAST LONGER, TOO!

..resale value!





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CERTIFIED PROOF
FORD TRUCKS
COST LESS

All tests conducted and results
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Send inquiry to: P.O. Box 2687 Ford Division, Ford Motor Co. Detroit 31, Michigan

'59 Ford Pickups Win Economy Showdown U.S.A.

–average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's ½-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested – by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

The '59 Ford Sixes, *in every test*, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both low- and high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's *Economy Carburetor is standard at no extra cost.*

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

Allis-Chalmers announces a new motor grader in the 80-hp class

... Another outstanding motor grader joins the Allis-Chalmers line
the ONE FORTY FIVE

MODEL D
58-hp Allis-Chalmers engine
8,800 to 11,450 lb

ONE FORTY FIVE
80-hp Allis-Chalmers engine
21,540 lb

FORTY FIVE
120-hp Allis-Chalmers engine
23,800 lb

move ahead with **ALLIS-CHALMERS....**

whole story firsthand?

BEST BUY IN THE MEDIUM-POWER FIELD

- Heavy-duty throughout at a budget-saving price.
- Designed for construction as well as maintenance of haul roads. Compact enough for tight turns powerful enough for production grading, scarifying, cutting ditches for drainage.
- Retains the widely-accepted characteristics and performance features of the 120-hp Allis-Chalmers FORTY FIVE grader.
- Offers the best combination of operator features of any grader near its size.

Operator advantages no other medium-priced grader can give you . . . "wide-open" visibility . . . over-the-circle lift cases . . . suspended pedals and exclusive no-kick, toggle-type controls.

Power for high production. Husky, high-torque Allis-Chalmers diesel engine handles overloads without shifting down . . . geared for good range of travel and working speeds.

Load-handling ability second to none. The new *ONE* FORTY FIVE has a 26⅛-inch-high arched front axle—and highest throat clearance in its class. You get more dirt to the ROLL-AWAY moldboard and move it with efficient rolling action that uses less power.

See the new *ONE* FORTY FIVE motor grader at your Allis-Chalmers dealer's. Check its dollar-stretching price. Then check its 80 hp and 21,540 lb on an actual demonstration. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

ROLL-AWAY is an Allis-Chalmers trademark.

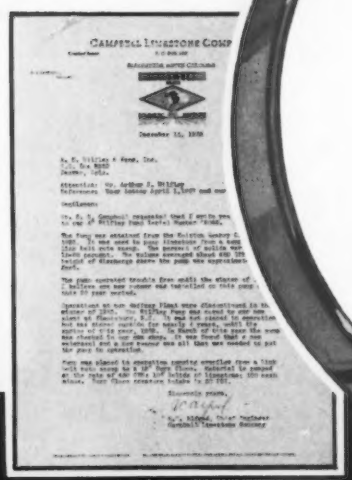
....power for a growing world

WILFLEY
SAND PUMPS

20 years service!

REPAIRS?... ONLY ONE RUNNER!

A Wilfley customer reports the following:

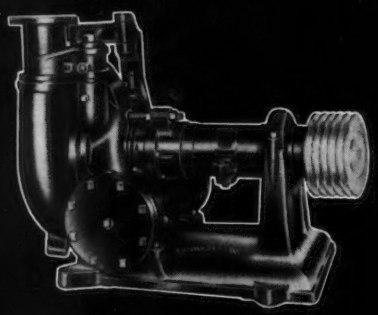


"The pump operated trouble free until the winter of 1953. I believe one new runner was installed on this pump during this 20 year period.

It was not placed in operation, but was stored outside for nearly 4 years until the spring of this year, 1958. In March of this year the pump was checked in our own shop. It was found that a new water-seal and a new runner was all that was needed to put the pump in operation."

Year after year Wilfley's reputation for dependable, low-cost pumping continues to build.

Individual engineering on every application.



WILFLEY ACID PUMPS
"COMPANIONS IN ECONOMICAL OPERATION"
WILFLEY SAND PUMPS

A. R. WILFLEY and SONS, INC.

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ENGINEERING AND MINING JOURNAL

MARCH 1959

Uranium at the Crossroad

DURING THE LAST DECADE, Colorado Mining Association annual conventions have mirrored progress of the nation's greatest mining boom—the growth of uranium from somnolence, to boom, to sobriety, and now to anxiety. As reported on pp. 101 to 104, great concern has been expressed at the February CMA National Western Mining Conference over the future of uranium mining during and after the 1962-66 period when AEC present purchase agreements may run out.

A quick review of the Colorado Plateau boom reveals the reason for the present status of the industry, and may provide the clues to its future. Back in 1947, following the critical World War II needs of the U.S. for uranium, producers of U_3O_8 had warehouses full of yellow cake, and didn't know what to do with it. There was no market. Then came the Korean crisis, and the knowledge that World War II had failed to stamp out dictatorship and the threat of political and military domination of free but helpless nations by bigger powers.

Thus, Free World defense again became a necessity, and AEC announced its program to stimulate domestic uranium production with a guaranteed price for uranium in ores, and other bonuses. A period of somnolence followed during which most major mining companies ignored the opportunity, and bean farmers and ranchers on the Plateau were among the active prospectors and producers. A crescendo of successful and profitable discoveries culminating in the bonanzas discovered by Pick, Steen and Cooper and Bronson brought the Plateau and other areas to the boom stage; first in exploration, then in production, and finally in the processing of uranium ores. The domestic uranium industry grew from virtually nil to a $300-million-a-year industry in little more than a decade, stimulated, of course, by the fact that the U.S. Government provided an assured market, guaranteed prices for six to eight years in advance, and spent millions to aid prospectors and developers through bonuses, haulage allowances, and other services rendered by the AEC and other Government agencies.

When it became apparent that the tremendous momentum of this new industry would yield production that would overshoot foreseeable demands for uranium for industry or defense, the AEC had to take action. This came last November in the form of announced limitations on the amount of concentrates which the Commission would accept in the future. But despite this action, Jesse Johnson, director of AEC's Division of Raw Materials, told Colorado miners that domestic uranium concentrate production will have a value of more than $300-million in 1959, and may continue at about that level through 1966.

Despite the favorable market for the next eight years, uranium producers are apprehensive about the post-1966 period. The many talks given at the CMA meeting on atomic energy gave no clear indication that the commercial market for uranium immediately after 1966 would sustain a strong domestic industry. Taking a leaf from the book of experiences of copper and lead-zinc producers, it might be wise for uranium producers to plow back some of their earnings into research and market development projects that will speed up the establishment of free commercial markets. As in the case of lead-zinc industry, this might profitably be a joint enterprise of important producers all over the world. If we made this assumption, also that 3% of the gross is a reasonable figure for research and market development, the R&D appropriation of world uranium producers should properly be in the neighborhood of $20-million annually ($10-million domestically).

Where would this money go? Perhaps into joint efforts with utilities to develop atomic power; with the oil industry, to develop atomic tankers; or a joint program with the copper industry to develop equipment to convert salt water into fresh water economically. Industry hasn't even begun to explore the possibilities of process heat. Researchers are hinting increasingly about a breakthrough in the direct production of electricity from heat. An imaginative, dynamic program for the development of uranium markets could move in many directions. The important point is that it should be started soon, and that its proponents dare "to think big", because atomic processes will not shackle themselves to the limited industrial concepts of today.

We have no inside information on what the Atomic Energy Commission thinks today, but judging from Jesse Johnson's comments about diverting uranium fuel production "into commercial channels" it's our guess that the AEC would applaud the greater participation of private industry in the development of commercial markets for uranium.

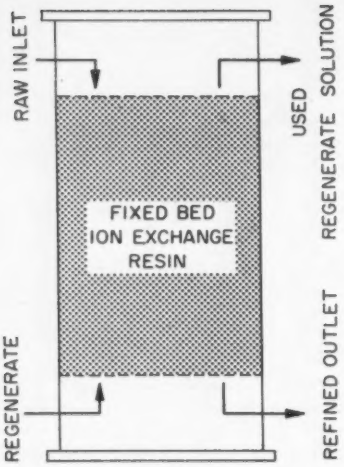


FIG. NO. 1. Fixed bed ion exchange is limited in throughput/resin unit.

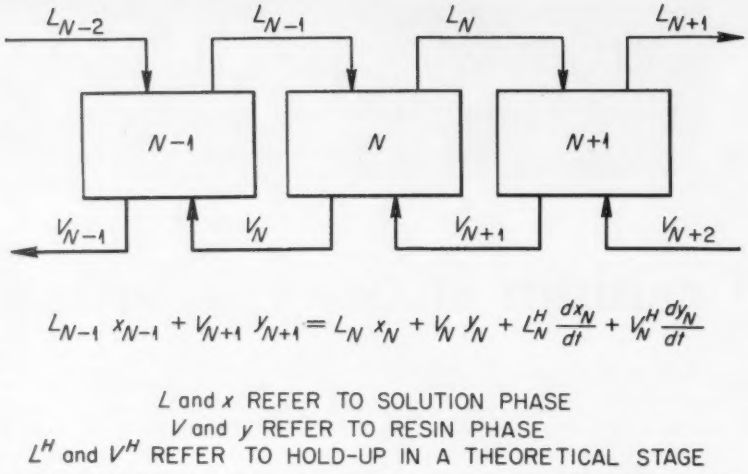


FIG. NO. 2. Material balance for unsteady-state system can be written as above using the theoretical stage concept to determine length of resin bed required.

Comparing Fixed and Moving Bed

C. W. HANCHER

EVER SINCE THE DISCOVERY of natural ion exchangers; for example, green sand and Zeolite, ion exchange has had the potentiality of becoming one of the major unit operations in the separations field. The limitations of fixed-bed ion exchange; namely, throughput per unit of resin and product concentration uniformity, emphasized the need for continuous ion exchange processes.

A fixed ion exchange bed, as the name implies, is a stationary bed of ion exchange resin through which liquid is passed (Fig. No. 1). It has fixed ionic capacity and flow rate-pressure drop limitations. During the loading cycle, liquid with ion to be removed is percolated through the exchanger and ions are transferred. The controlling factor of the loading cycle is refined outlet concentration of the ion in question. In most operations, even when the equilibrium separation factor is large, only a small percentage of the resin is saturated to capacity before the refined outlet concentration is too high for economical operation. Then the ion is stripped. Since only part of the exchanger is loaded to capacity, the ion concentration in the stripped liquid is low. This is only one of the difficulties encountered with a fixed bed ion exchange.

In the design of continuous countercurrent ion exchange contactors there is a need to determine the length of resin bed required to effect a given separation. A convenient method for estimating this length is the concept of the theoretical equilibrium stage. Define a theoretical stage as a definite device that discharges separated phases which satisfy the equilibrium relationship. Now, this length of bed can be represented as the product of the height of a theoretical equilibrium stage (HETS) and the number of equilibrium theoretical stages (NETS). Using the theoretical stage concept, a material balance for the unsteady stage system can be written (Fig. No. 2). In a stage wise separation process there is only a steady state approach to equilibrium. The last two terms of Fig. No. 2 are zero.

Mr. Hancher is chemical engineer, Unit Operations Section, Chemical Technology Division, Oak Ridge National Laboratory (operated by Union Carbide Nuclear Co.). This paper was presented at the Gordon Research Conference, Merden, N. H. in August 1957.

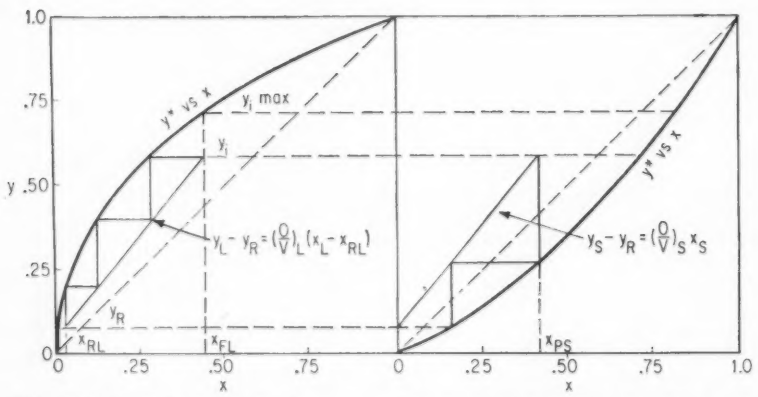


FIG. NO. 3. McGabe-Thiele diagram may be used to determine the theoretical stages by diagramming the stages between material balance and equilibrium lines.

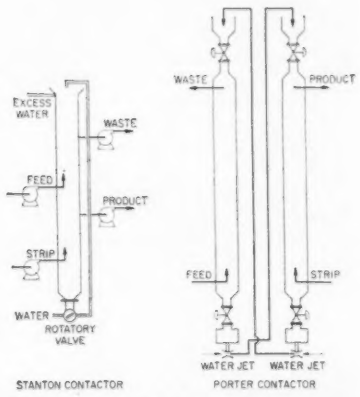


FIG. NO. 4. The Stanton contractor consists of a column, valve and catch pot.

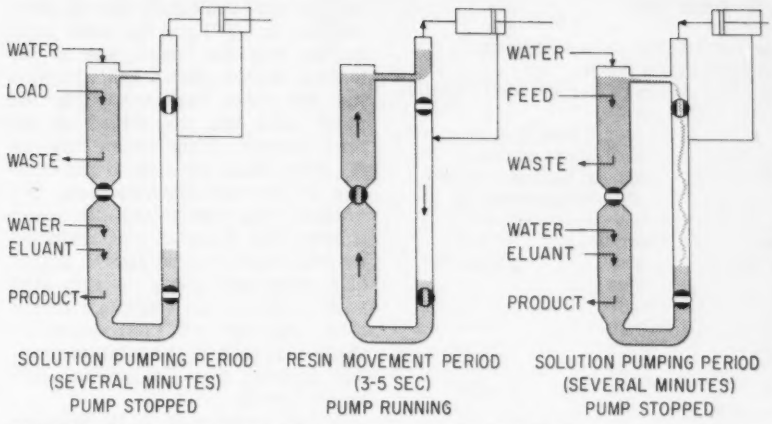


FIG. NO. 5. The Higgins column is similar to an inverted Porter column, but because of the smaller and more frequent resin movement is more nearly continuous.

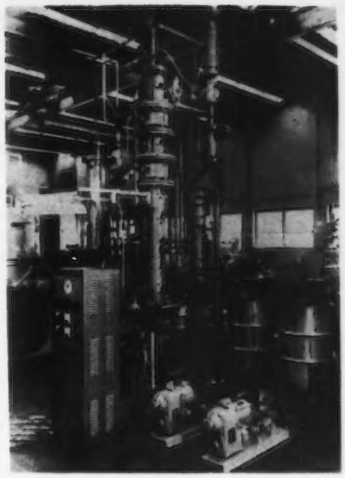


FIG. NO. 6. ORNL built this 12-in. dia Higgins column for the AEC.

Ion Exchange Techniques

A standard McCabe-Thiele diagram (Fig. No. 3) may be used to determine the number of theoretical stages. A McCabe-Thiele diagram is a graphical method for determining the number of theoretical stages in a separation process at steady state by stepping off stages between the material balance operating line and the equilibrium line. On this diagram, let y equal the equivalent fraction of ion under consideration in the resin phase compared with the resin capacity and x the equivalent fraction in the liquid phase compared with total ions in solution. Once the operating conditions are established, an operating line can be drawn on the equilibrium diagram and stages stepped off on the diagram. For design purposes the total stages must be considered, but for correlation of data, partial stages must be considered. If the stripping and loading section equilibrium diagrams are placed side by side, the resin leaving the stripping section is seen to have the identical ion concentration as that entering the loading section, and the resin leaving the stripping section has the same concentration as that leaving the loading section. Therefore the diagrams are dependent on each other, and the operating lines are in definite ratios to the feed-resin flow-rate ratios.

The "continuous" systems that have been developed are really systems in which resin is moved intermittently, by an outside force, countercurrently to liquid flow. These are, however, usually referred to as continuous systems because the resin moves at regular, closely spaced intervals. Although their physical layouts differ, the modes of operation are similar. The percentage of bed moved per cycle varies from 25 to 0.5%.

The Stanton contractor (3) (Fig. No. 4) consists of a column with a rotary valve and catch pot at the bottom. The resin is moved by going through the rotary valve and dropping into a catch tank, from which it is jetted with water to the top of the column. The liquid flows countercurrently up through the column. There is no valve or material block between the sections, which are isolated by flowrate control. All the flows are metered in and out of the sections, and a zero pressure drop is maintained between the two or more sections. The maximum flowrate is determined by the resin fluidization rate.

In the Porter contactor the loading and stripping sections are separate. Each section consists of a column which has an inlet and outlet and a valve at the bottom and top for resin to come in and out. About 20% of the resin is allowed to drop from the column into a hold tank (Fig. No. 4). This resin is jetted or mechanically transferred to the next column with water, and a proportionate amount of resin from that column is jetted back to the first column. After the resin has been moved, the resin valves are closed and liquid flows countercurrently to the resin as in a fixed bed operation. This column is more like a fixed bed column than Stanton's because a greater proportion of the resin is moved at one time and the resin is in a fixed bed state for a longer period of time.

The Higgins column (1) is similar to an inverted Porter column, but, because of the smaller and more frequent resin movement, more nearly approaches a truly continuous operation than the Porter contactor. It consists of two active sections fitted with inlet and outlet sections and a reservoir and feed tank section. The sections are connected into a loop, with valves between the sections (Fig. No. 5). The resin is moved by applying a hydraulic pulsing force across the bed, which allows water to move through the bed and carry the resin with it. A convenient way to describe the resin movement is by the "slip-water ratio", which is the volume of water required to move the resin divided by the volume of resin moved; in small contactors this ratio may be 3 or 4:1. However, as the contactor diameter increases, the slipwater ratio should decrease, because an infinite-diameter column would have zero surface area due to the side walls and therefore should have a slip-water ratio of 1:1. Slip-water causes back-mixing which reduces the exchange efficiency of the contactor.

Operation of the 6-in. dia Higgins unit was reported previously. (1) From the data obtained a 12-in. dia unit (Fig. No. 6) was constructed at ORNL and installed in the AEC pilot plant facility at Grand Junction, Colorado, operated by National Lead Co. The 12-in. unit was operated for about 25 days on actual ore slurry

Table No. 1. Stripping Section Performance in Tests II and III

U loading on resin: 65 g/liter
Resin pulse height: 3 to 6 in.
Pulse frequency: 5 min
Slip-water ratio: 4.2/1.0

Strip: 1 *M* NH_4NO_3—0.1 *M* HNO_3
Acid wash: 0.5 *M* H_2SO_4
Slurry feed: density, 1.05 g/ml; 8 to 10% solids

	Test I Ore rate 12 tons/day, Material balance—104% Flow balance—101%		Test II Ore rate 16 tons/day, Material balance—104% Flow balance—98.7%	
Stream	Flowrate[a], gpm	U Conc., g U_3O_8/liter	Flowrate[a], gpm	U Conc., g U_3O_8/liter
Strip	0.45	—	0.45	—
Strip wash	0.57	—	0.58	—
Acid wash	0.08	—	0.16	—
Waste	8.20	0.002	11.25	0.003
Slip-water	0.30	—	0.40	—
Produce	0.60	12.10	0.90	10.30

[a] 7 gpm = 580 gal/hr/ft²; 10 gpm = 860 gal/hr/ft².

Table No. 2. Calculated HETS for Loading and Stripping Sections for Tests II and III

Test	Feed rate, gpm	Liquid resin flow ratio	Effective[a] bed height, ft	NETS[b]	HETS[c] Actual	HETS[c] Design
			Loading Section			
II	7	87	5	3.9	1.2	1.8
III	10	83	6	3.9	1.54	1.8
			Stripping Section			
II	7		7	1.5	4.7	2.7
III	10		Incomplete data			

[a] Actual depth of ion-exchange bed in the loading section was 8 ft.
[b] Number of equilibrium transfer stages.
[c] Height of equilibrium transfer stage.

feed. Test I was reported previously.(1)

From the data (Table No. 1) taken during Grand Junction Tests II and III in September 1956, with a 12-in. dia continuous ion exchange contactor at a feed rate of 7 gpm (8 to 10 wt % solids), the numbers and heights of equilibrium theoretical stages for the loading and stripping sections were calculated (Table No. 2). The discrepancy between design and experimental results is partly explained by the fact that the design was based on a feed uranium concentration of 0.57 g/liter. The actual feed concentration was 0.98 g/liter.

During the first part of Test II, the uranium content of the waste was higher than that at the bottom of the loading section, and the tops of the stripping and strip wash sections were also high in uranium. It was assumed that the stripping rate and strip washing rate were sufficiently slow to allow uranium to bleed past the water wash section into the return line to the loading section. Any uranium carried past the water wash section by the pulse water was not sorbed by the resin because of the nitrate ions on the resin. Since the resin is not sorptive at low acid concentrations, this uranium was washed into the waste stream. This situation was corrected by introducing 0.5 M H_2SO_4 instead of a water wash above the strip inlet point. Sulphate ion equivalent to the resin capacity was introduced to change the resin to the sulphate form, thus assuring that the uranium was readily sorbed.

Grand Junction Test III was for the purpose of determining the limiting column section or auxiliary component of the 12-in. dia contactor, and the feed rate was increased from 7 gpm (12 tons/day) to 12 gpm (20 tons/day). Two mechanical limitations were apparent: the feed pump, with a rated capacity of only 11 gpm, and the slip-water eliminator ½-in. dia opening, were too small. At the 12 gpm rate the pressure drop across the feed section was 50 to 60 psi and the Moyno feed pump broke a bearing pin from being overloaded. The rate was then decreased to 10 gpm (16 tons/day or 860 gal-sq ft/hr) and the column was run for 6 days. At this rate the feed pump was still running with an apparent overload, and occasional shutdowns were necessary to repack the bearings. The pressure drop across the loading section was 20 to 40 psi.

At a feed rate of 10 gpm the product concentration was 10.30 g of U_3O_8 per liter and the recovery was 99.6 (0.003 g of U_3O_8 per liter loss). There was some doubt of steady

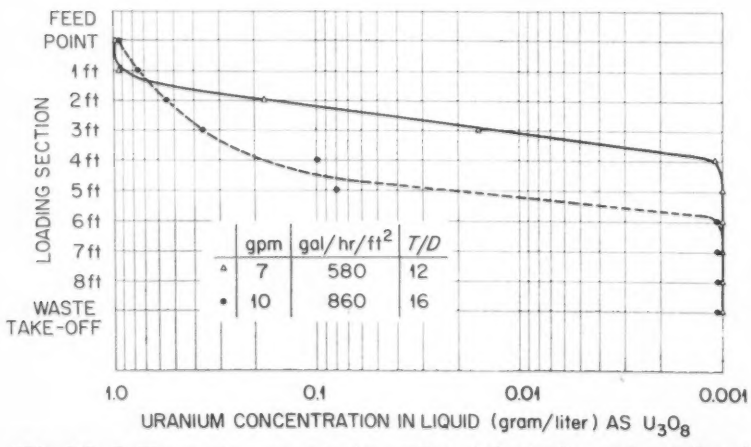


FIG. NO. 7. The uranium concentration profiles of the loading section indicated that the HETS (height of a theoretical equilibrium stage) depends on the flowrate.

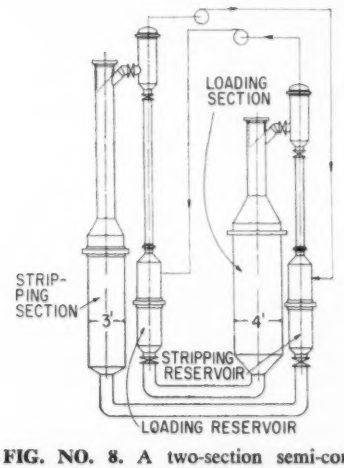


FIG. NO. 8. A two-section semi-continuous counter-current contactor.

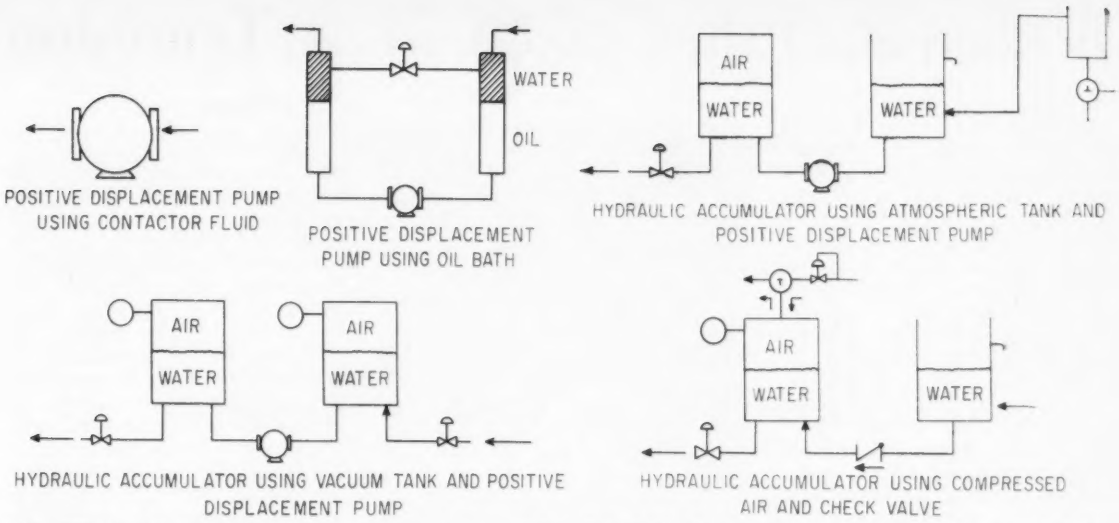


FIG. NO. 9. Pulsing mechanism for semi-continuous solid-liquid contractors, as diagrammed above, was installed on the Oak Ridge National Laboratory 36-in. dia resin test loop. Mechanism must provide three specifications (see text).

state conditions because of occasional shutdowns.

In Test III, as in Test II, the HETS in the loading section increased with increased flowrate. The HETS for the stripping section could not be calculated because of lack of data.

The uranium concentration profiles of the loading section indicated that the HETS depends on the flowrate (Fig. No. 7).

At Oak Ridge National Laboratory a 36-in. dia resin test loop has been constructed. This loop will be used to establish the power requirements for pulsing a resin column of this large diameter. It is half of a two-section contactor, which has been designed (Fig. No. 8). The pressure drop, if the resin was pulsed through both sections with only one pulsing system, would likely cause a very large slip-water ratio. There may also be some advantage in having individual control of pulsing through the section. If a slurry is being fed, the frequency should be greater than when a clear feed is used; however, the amplitude would be less so that the bulk total flowrate is constant.

A pulsing mechanism must be able to deliver a large amount of water (30 gpm ft^2) at relatively high pressures (50 to 100 psig) for short periods of time (1 to 10 sec). During the early development of the Higgins contactor a gear pump was used to pump water to move the resin. For small contactors a gear or piston pump was satisfactory. However, as larger diameter contactors were constructed, and the resin volume increased, it was difficult to design suitable mechanical pulsers. When a pulsing mechanism was chosen for the 36-in. dia resin test loop the following specifications had to be met:

1. 200 gpm flow rate
2. Controlled flow times of 1 to 10 sec at full capacity
3. Discharge pressures of 50 to 100 psig

Therefore a hydraulic accumulator system was installed (Fig. No. 9).

The compressed air and check valve system was picked because of the difference in maintenance between a liquid pump and air compressor. A 120-hr test was made to define the operating area for hydraulic stability, and the conditions for minimum slip-water ratio. The contactor was pulsed for time intervals of 1, 2, 3, 5, 7, 8, 10 sec at pulse pressures of 20, 30, 40, 60, and 80 psig. For pulse pressure of 60 and 80 psig, the slip-water ratio for all time periods was 2:1, or lower (Fig. No. 10), which is in the desirable range. The 12-in. contactor at Grand Junction operated at slip-water ratios of 3.0/1.0 to 55./1.0. At these high ratios, back-mixing is increased, resulting in greater HETS values.

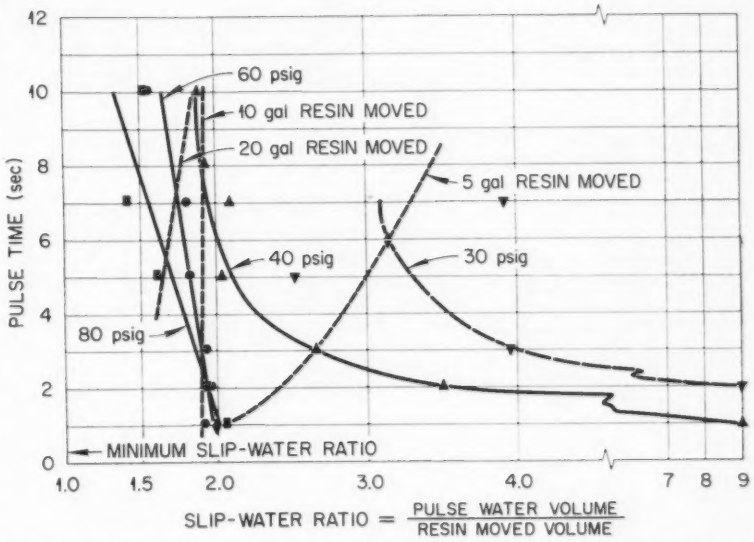


FIG. NO. 10. For pulse pressures of 60 to 80 psig, the slip-water ratio for all time periods was 2:1 or lower, which is in the desirable operating range.

References

(1) T. A. Arehart, et al., *Chem. Engr. Prog.* 52, 52 9, 353-360 (1956).
(2) R. H. Guymon, et al., "Uranium Raw Material Process Cost Estimates 1 Through 10", ORNL-1998 (1955).
(3) L. F. Stanton, M.S. Thesis, University of Washington (1950).

Trunnion

E. J. KLOVERS

MOTION IN GRINDING MILLS is not confined to the rods and balls which function with the ore. As size of mills has increased, mill operators have had to pay increased attention to gearing, the pinionshaft bearings, and the trunnion bearings. In the latter case, lubrication practice, and the necessity for regular attention by the operator to the trunnion bearing of the newer and larger mills has often been a problem.

A new lubricating system introduced by Allis-Chalmers Manufacturing Co., attacks trunnion bearing problems by providing lubrication while the mill is starting, during the run, and while the mill is idle. The new system, called "Lubritrol," also cools or heats the lubricant as required and continuously filters out any contaminants.

The drawings at left show the growth of trunnion bearing lubrication techniques, starting with the typical bearing (Fig. 1) with a self-contained internal lubricating system and a separate manually operated high pressure system to be used prior to and during the startup of the mill. This type of combination lube system has been successfully employed for the past 20 years on mills up to and including the 1500 hp sizes.

By vigorously stroking the manual high pressure pump, it is possible to inject 15 to 25 oz of lubricant into the bearing directly beneath the trunnion to literally float it. An indicator arranged to read the vertical movement of the trunnion has recorded a lift varying from 0.002 in. to 0.009 in. The exact amount of lift depends on the quantity of oil pumped, its viscosity and the fit between the trunnion and its bearing. The combination of self-contained system and manual system is good and entirely adequate if the following three conditions are met:

1. Operating personnel must religiously employ the manual high pressure pump every time the mill is started. The pump should be used continuously about 15 seconds before and 15 seconds after the mill begins to roll.

2. The bearing oil reservoir must be held to the proper level.

3. Oil in the reservoir must be kept free of contaminants.

About a year or two ago, it was realized that yet another condition must be met: that of permitting a stationary mill to cool and shrink

The author is a member of processing machinery department, Allis Chalmers Manufacturing Co.

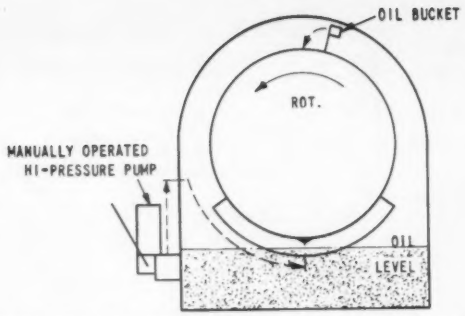


FIG. 1 Typical trunnion bearing was lubricated manually with a high pressure pump. Trunnion buckets are a part of the internal self-lubricating setup.

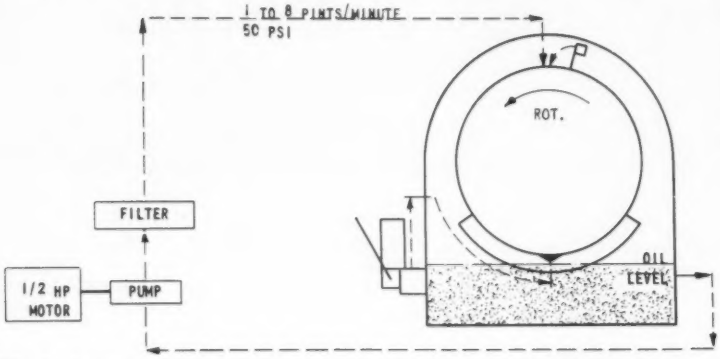


FIG. 2 Low pressure recirculating system includes a motorized pump and filter, and is capable of adequate protection during starting, run, and cooling off.

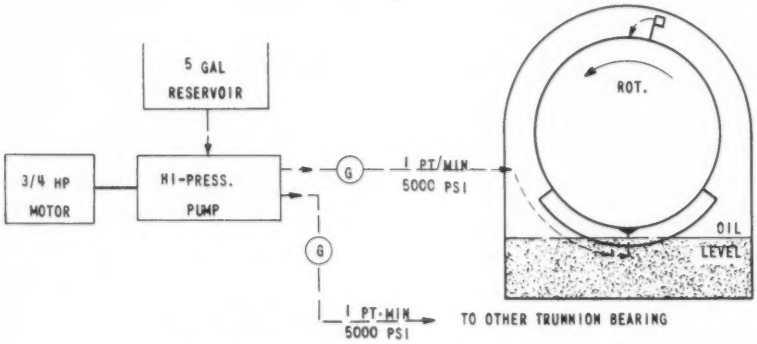


FIG. 3 The next step in development was the introduction of a motorized high pressure pump. While effective in starting and floating, it was still manual.

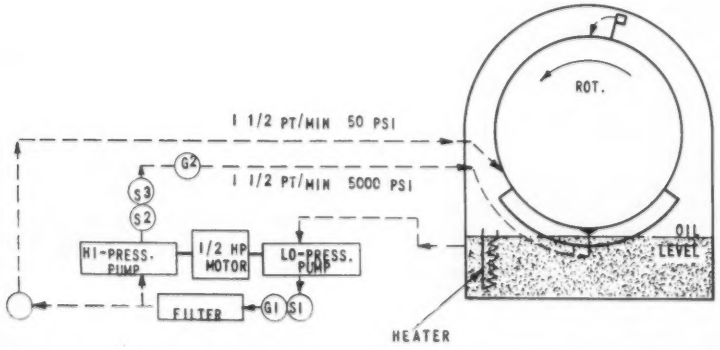
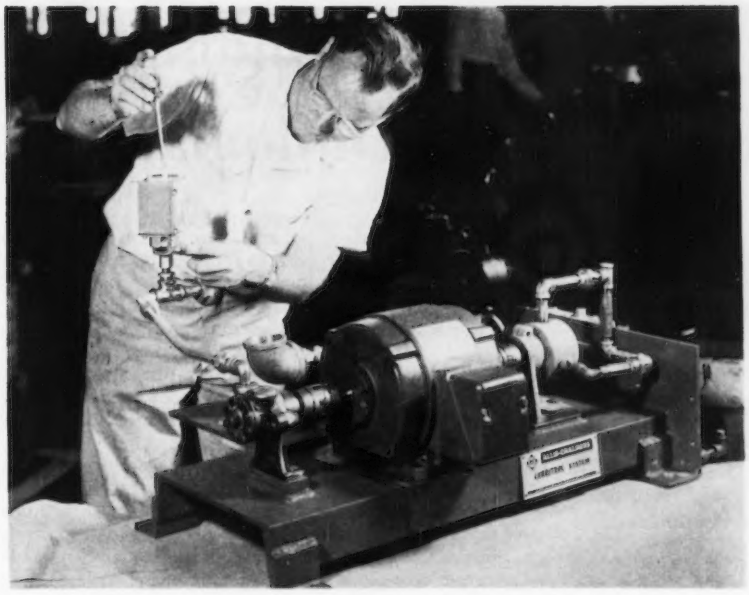


FIG. 4 The new system is completely controlled and automatic, operates whether mill is starting, running, or idle. Each bearing requires a separate system.

Bearings Profit From Full Lubrication



INSPECTION of one of the new systems takes place at the plant. Unit filters, cools or heats the lubricant, operates on low horsepower at low cost.

without restriction. During grinding, mill temperature will increase, since 80% of the electrical energy motor input is heat absorbed by the mill and its charge. Assuming a 30 deg F rise due to heat, a mill having an 18 ft bearing center distance will expand 0.042 in. The trunnion bearing opposite the gear end is designed to accommodate this growth while the mill is rotating. However, when a warm mill is shut down, it must contract until all parts return to ambient. If this contraction occurs between a dry, unlubricated trunnion and its sleeve bearing, considerable bearing distress may occur. The very least result will be reduced bearing life.

While the mill is contracting, its shrinkage is being resisted by the bearing piers; and this resistance will be reflected by a bending stress in the pier.

A high film strength oil will minimize bearing distress due to contraction and sliding of dry surfaces. However, the best solution is the periodic use of the manual high pressure pumps during the cooling off period. Apparently, the majority of operators neither recognize this necessity nor can afford the time required for a man to float the mill or mills during this critical period.

Fig. 2 is a schematic drawing of a simple low pressure recirculating system, consisting of a motorized pump and filter. Often, other refinements are included such as a cooler, heater, flow metering valves and pressure switches. The low pressure system, when used with the manually operated high pressure system, is capable of adequate bearing protection during starting, running and cooling off periods. However, the high pressure pump remains non-automatic.

About two years ago, at a western ore concentrator, a motorized high pressure pump was placed into operation on the bearings of a 10½-ft diameter ball mill. The motorized pump was a part of a system as shown in Fig. 3. It was developed primarily so that a single operator, by means of push button control, could simultaneously float the mill and start it. It was reported that the breakaway pressure was 1800 psi, the static lift pressure was 800 psi and the dynamic lift (mill rotating) was about 550 psi. The system has been satisfactory, but it remains a manually operated one. It requires frequent inspection of bearing reservoir oil level and of the high pressure lines. The motorized pump forces in a considerable quantity of oil if run frequently or for too long a period, and it is necessary to drain the excess oil. If this is not done, the oil usually leaks through the bearing seals against the piers or on the floor. The system could have been modified to permit the mill to shrink during cooling off by the use of a timing device which would periodically start and stop the high pressure pump motor after the mill had stopped, but the arrangement would not be practical since the total quantity of oil delivered to the bearing during a week of "up and down" operation might be considerable. The system was never developed beyond this stage, for it became apparent that it was to be combined with the low pressure recirculating system.

Fig. 4 shows the "Lubritrol" combination of high and low pressure systems, with features to make it completely controlled and automatic. In this system, about three pints of oil per minute are drawn from the bearing reservoir and returned via two channels; about 1½ pints per minute under high pressure directly below the trunnion, and the remainder delivered to the top of the trunnion. The pump delivering the high pressure oil is capable of pressures as high as 5,000 psi. In actual practice, the break away, the static lift and dynamic lift pressures are near those recorded at the western concentrator mentioned earlier. The 1½ pints per minute of low pressure oil is deposited either at the top of the trunnion or at the incoming chamfer of the bearing. This low pressure oil and that oil which is brought up by the internal bucket system will be pulled into the bearing as a hydrodynamic wedge once the trunnion is rotated.

Each bearing requires a separate system, which has one motor of a half horsepower size directly coupled to the low pressure and high pressure pumps. Only a fraction of this horsepower is required for operation once the trunnion is floated and rotating. Because of the small expenditure of horsepower there is no reason to stop the system at any time. Actually it is of advantage to allow it to operate continuously. Advantages are:

1. The oil within the bearing is continually filtered and freed of contaminants. The filter will remove all particles above 25 microns size and will absorb water that often collects in the bearing interior as condensate from the atmosphere.

2. Although very few dry grinding mills require the cooler, its use assures the bearing of a supply of cool lubricant. This is important if an unusual amount of heat is generated during grinding or if the material introduced into the mill is unusually hot.

3. The heater within the bearing reservoir will hold the oil to about

(Continued on p 160)

A Challenge for the Mining Industry —Creating the Engineer-Diplomat

EUGENE PAUL PFLEIDER

LIKE THE "OLD GRAY MARE," mining today just isn't what it used to be. And if the prospective mining engineer is as wise as he's going to have to be, he will take a long look at the new implications, or what might be called the modern "fringe requirements" of the profession.

This isn't to say that the student can attach any less importance to the basic science and engineering courses. The groundwork remains as essential as ever. But the plain facts are that the job of the U.S. mining engineer today, particularly when working on the development of mineral resources in foreign countries, is a lot more complex than it used to be.

We live, work, and study in a scientific and technological world that not only can—but does—change overnight. We have moved from the first successful lift of the Wright Brothers' wings at Kitty Hawk to the space-eating satellites which even now buzz our planet at 18,000 miles per hour—all within the lifetime of many of us still here who started our lives on a leisurely earth traveling by horse and buggy.

Along with everything else, the mining industry has changed. The primitive era of the horse-drawn, two-wagon supply "freighters," the ore-carrying burro and mule teams, and the pick and shovel which flourished as recently as the Twenties is now ancient history.

With technological and social advance, however, has come a widening of the world of the mining engineer, the geologist and the mineral dresser. These men may very well spend much of their careers in foreign nations where, as has become painfully clear in recent years to U.S. citizens overseas in every walk of life, their objectives and even their presence may not be automatically understood or welcomed on every hand.

The challenge, then, lies in the fact that—as our mining industry extends its operations into countries abroad at an accelerating rate—it inevitably creates a new dimension of responsibility shared by all U.S nationals representing American mining enterprises in those countries. The basic problems have existed for many decades, but they are now of prime importance. The mineral-wealthy but underdeveloped nations have developed an understandable pride in, and desire to exploit, their own natural resources. More specifically, they want to retain financial control and to staff both executive and operating groups. Expropriation or excessive taxation are but two of the possibilities faced by the unwary investor from abroad.

To function successfully overseas, the American mining engineer must cover a much wider field than the one which confronted those who came before him. In addition to knowing and keeping up with his own constantly changing and increasingly complicated trade, he should know a lot of other things not commonly associated with science and technology.

He should certainly know as much as he can learn about the country he works in: its history, its laws, its government, its language, and the manners and mores of its people. He should have the capacity to be an effective U.S. ambassador of goodwill. He should possess the background knowledge and the ability to be an articulate spokesman for our democratic principles, our economy, and our way of doing business. He should have the tact, or the intuitive sense of the diplomat—knowing when to speak, and when to be a good listener.

He should be aware of the major lines of political thinking in the resident country but equally aware of the pitfalls of taking sides in a purely local political controversy. He should know the attitudes of political and other groups toward the United States in general and toward his own enterprise in particular. He should also have a weather-eye out for changes in those attitudes as well as for events which might change them.

He should know not only the technical aspects of his operation, but its administrative and financial aspects as well—to the extent, at least, that they impinge on the local scene. What, for example, will be the earnings of his company relative to tax and other revenues which will accrue to the host country? How many of the choicer operating jobs will be held by nationals? What possibilities are there at the current project which may open the way to other projects in the same country?

It goes almost without saying, of course, that as a mining man he should know the philosophy and vital provisions of the mining laws of all countries in which U.S. mining enterprises are located. In fact, just so long as he stays in the mining business, he should make it a habit to stoke up with everything he can come across about U.S. mining operations in foreign countries—in all aspects.

Some of these points were brought home to me at firsthand as a result of my work as a mining consultant for the Freeport Sulphur Co. in Cuba This company is presently undertaking a vast nickel-cobalt enterprise at Moa Bay on Cuba's northeast coast. And the fact that the enterprise represents the largest single privately financed

The author, a consulting mining engineer for Freeport Sulphur Co. since 1950 at its Cuban mining operations, is professor and head of the Department of Mineral Engineering of the University of Minnesota's School of Mines and Metallurgy. He is past chairman of the education division, Society of Mining Engineers, and former chairman of the mining, geology and geophysics division of AIME. Prof. Pfleider was one of the group of about 50 U.S. and Canadian citizens kidnapped last summer by the Cuban revolutionary forces which ultimately overthrew the Batista regime.

venture in the history of Cuba gives it singular prominence in economic, political and other circles in that island nation.

Quite apart from solving the complex mining and metallurgical problems involved in extracting nickel and cobalt as metals from the lateritic deposits, it was equally important that Freeport obtain the full understanding and support of the Cuban government and the Cuban people. This understanding and support had to go beyond routine matters of permits and licenses. It involved basic and indispensable questions of financing—for, without the partial tax exemption as a new industry which only the government could grant the enterprise, the company would not be able to pay off the loans in the specified time and accordingly could not have obtained the necessary financing. And financing was crucial, for the total required investment of $119-million was far beyond Freeport's own financial resources.

To give government officials and the public a full understanding of what was involved, Freeport cited what other countries had done, or had not done, to stimulate development of mineral resources. The mining laws and policies of Canada and the Philippines were used as examples.

In the case of Canada, the country was certainly an enlightened one and had no need for foreign assistance, yet it had the most favorable mining laws for stimulating the development of mining operations by outside firms, and consequently had profited greatly from such development —as the world well knew.

Canada's realistic mining philosophy was then compared with that of the Philippines government in 1957 when, after widespread advertising for bidders to develop government held nickel deposits, not a single bid was received, and the failure was admitted by government officials to have been caused by unrealistic financial demands contained in its mining laws.

As for the Moa Bay project, attention was drawn to the fact that it would have been impossible to finance the $119-million outlay required to establish the operation without the enabling provisions for new industry contained in Cuban Law Decree 1038, which provides partial tax exemption for a limited period.

It was also pointed out that, while the partial tax exemption period theoretically extended for 10 years, the first two years would be spent in construction,when there could be no profits. The effective period, therefore, was only eight years Also, during the exemption period the government would receive in taxes almost 20% of profits, and afterwards almost 50%.

What was perhaps more important to Cubans at large, as was stressed in advertising and elsewhere, was the fact that some 3,000 Cubans would be employed in the project's construction, and after production began there would be permanent, year-round jobs for more than 1,000. The resulting payroll, together with payments for purchases and services, would contribute a direct increase of $15,-million to Cuba's national income in the first five years of operation alone.

These benefits, it was noted, were only a beginning. For, as a major breakthrough in the development of Cuba's mineral resources, the project would in all probability show the way to the further development of Cuba as one of the principal mining centers of the world.

This carefully documented approach on the part of Freeport's representatives in Cuba resulted in the granting of new industry benefits provided in the Cuban law to the Moa project. The approach, as the reader can see, involving not only engineering evaluations but also considerations of financing, tax payments, and in a broader sense, the general future economy of the island. Presented in this way, the Cuban government and the Cuban people did not fail to see the great benefits the project would bring, not only for the immediate present, but also for the future growth of a vital segment of the country's economy.

Each mining enterprise has, of course, its own particular problems, but the ability to recognize the implications inherent in the problem and to know how to achieve a solution is something which every U.S. mining engineer should strive to develop. In seeking the solution, he must take into account the social and sociological background of the people with whom he is dealing. Much of the world is in a state of social ferment, and firsthand knowledge of the ingredients producing this ferment—in any country where U.S. mining operations may be called upon to justify their existence—is obviously vital

Greater numbers of people doing business in foreign countries are becoming more and more concerned over the labels of "Yankee Exploiters" and "American Imperialists," which are pinned on them by the political demogogues and opportunists. They have started doing something about counteracting the attacks. Therefore, the challenge to U.S. mining abroad boils down to this question—is there some sensible step for the mining industry to take which would produce long-range results in a minimum of time?

There appears to be one step which is not only sensible, but also inevitable. And if the objection should be made that time is running short, then that is the chance we must take. Simply put, we should start training our mining engineers to cope with the new dimension we have created for ourselves. If our engineers cannot cope with it, they will at best work under a very serious handicap abroad. At worst, in some places, they will not work at all.

To Establish a Program

As an industry, therefore, we should individually and collectively take the following initial steps looking toward the establishment of a program of effective action.

1. Do some prompt and serious thinking about revision of our engineer-training programs to provide more cultural studies in addition to those of science and technology.

2. Consider the establishment of industry scholarships in the U.S. for the special training of our new breed of engineer-diplomat, the recipients to be both exceptional U.S. students and outstanding nationals in the country of operations.

3. Consult with the faculties and administrative heads of selected secondary schools, looking toward the inclusion of more cultural studies for pre-engineering students, particularly languages, philosophy and psychology.

4. Bring to the attention of pre-engineering students, and present engineering students, the requirements of the new dimension—through talks with selected groups and through distribution of literature.

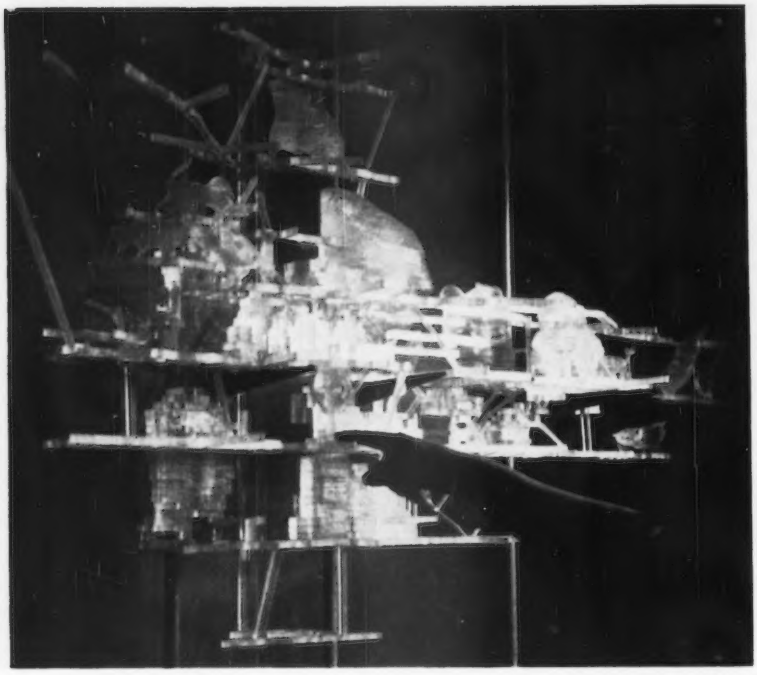
5. Consider the holding of a special seminar to enable members of the industry to compare notes with other members on what each is doing and planning to meet the new challenge in their respective areas of operation.

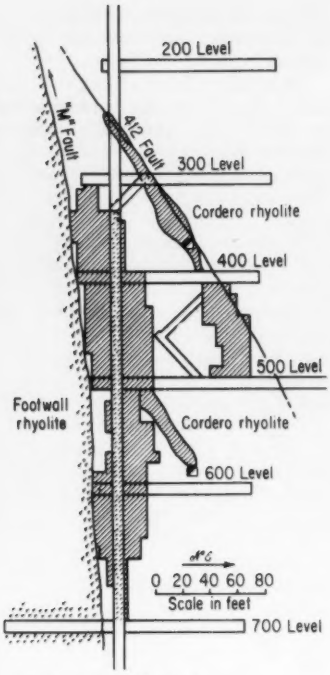
6. Step up current activities aimed to acquaint present engineering personnel with sufficient background information to "hold the fort" successfully (while we are preparing our new model mining engineer)—through special meetings and literature.

In conclusion, one statement bearing directly on the challenge (and opportunity) deserves repeating here:

"We will need not only Einsteins, but Washingtons and Emersons."—Dwight D. Eisenhower

But the mining industry must awaken to the fact that in order to entice and hold the exceptional man, it must compete with some very well paid and dynamic new scientific and engineering fields. Further, the industry's moral and financial backing is badly needed by the mining engineering schools charged with the responsibility of educating exceptional men.





CINNABAR is near cracks in rhyolite — argillic altered below 500 and increasingly silicified above.

Cordero—Nevada's Largest Hg Mine

J. ELDON GILBERT
and
VERNE P. HAAS

QUICKSILVER has an important place in the mineral industry of Nevada. Most of the output today comes from the north-central part of the state, principally from the Cordero mine of Cordero Mining Co. near the Nevada-Oregon border some 11 miles southwest of McDermitt. From 1939 to early October 1958, the mine has produced more than 62,500 flasks of quicksilver metal. Output in recent years has closely matched and at times surpassed that of California's famous New Idria mine.

Mr. Gilbert and Mr. Haas are manager and assistant manager of Cordero Mining Co.

The Cordero property was discovered and claimed in 1929 by two local men, Tomas Alcorta and Eusebio Aznarez. They noted the similarity of the opalite outcrops with those of the Opalite quicksilver mine to the east in Oregon. First systematic development work involving prospect drilling and sinking shallow shafts was done by Bradley Mining Co. in the early thirties. But the distressed quicksilver market prevented exploitation.

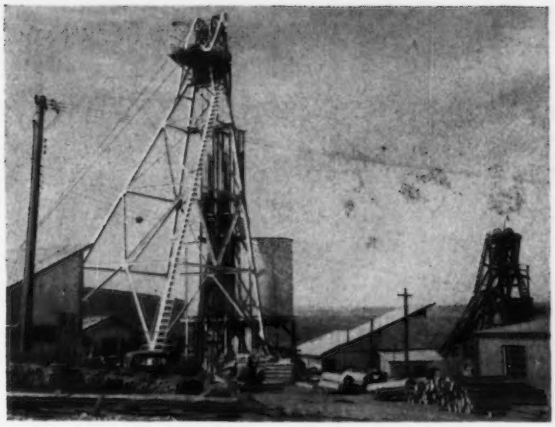
Cordero Mining Co. then known as Horse Heaven Mines Inc., entered the area in 1939, and after acquiring a lease on the property started exploratory work which was carried on through 1940. Sufficient ore was developed during this period to warrant starting construction of a processing plant in April 1941, and the first ore was burned in August 1941.

All ore treated during the years 1942 and 1943 was mined from open pits. But subsequent discovery of ore at depth by churn drilling changed the picture and during 1945, one of the best years in the mine's history, all ore came from underground workings. Low quicksilver prices caused an 11-month shutdown in 1948 and another one from March 1950 to August 1951; but since then the property has been in continuous operation.

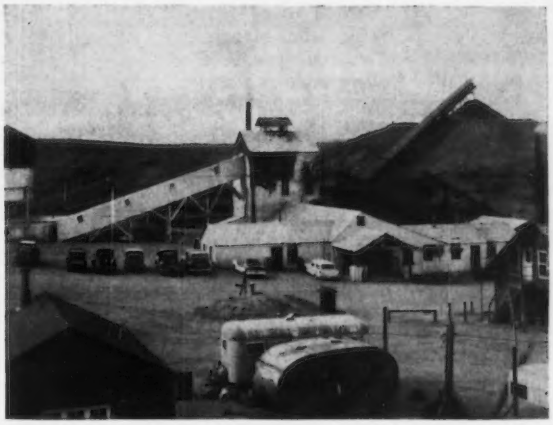
Geologically, the surface orebodies occur in highly fractured opalite and highly altered rhyolite. In general, they are related to slips and faults quite complex in character and detail. The "G" pit currently under exploitation a short distance from the New Brown shaft lies in a highly altered rhyolite.

All important underground orebodies are in rhyolites near a major fault, locally known as the "M" fault, which has a northeast-southwest trend and dips about 80 deg to the north. The host rhyolite on the hanging wall side of the fault has been highly altered at depth by argillic alteration. Silica removed by the alteration silicified rhyolites on the surface and converted them into glassy rock locally called opalite. Marcasite was then introduced, followed closely by cinnabar. The result is a pipe of ore at depth and smaller pockets and pods on the surface.

The pipe of ore is about 50 ft wide and 200 ft long with its long dimension parallel to the "M" fault. It extends from just above No. 3 level down to the deepest working



NEW SHAFT has 2-ton skips. Ore from shaft and nearby pit (13½ and 6 lb Hg per ton) is trucked short distance to the



PROCESSING PLANT which handles 110 tpd. Tall building houses multi-hearth furnace. Multi-pipe condenser is at right.

on No. 8 level. Within it, ore is controlled by numerous slips and faults stacked one on top of the other. As a consequence, the grade of ore is not uniform. Underground orebodies away from the pipe appear to be offshoots and in a general way rake toward it. The offshoots, still controlled by slips and faults, make good size pockets of ore.

Exploration on the surface consists of churn drilling, with a sample being bailed out every 5 ft of hole. A portion of each sample thus obtained is both panned and assayed. In addition, it is also checked at random by the chief mine engineer. In open pit work the floors are explored by drilling 2½-in. holes with a wagon drill at 6-ft centers. Samples are taken at 6-ft intervals and assayed. The holes are classified as ore or waste for blasting. Panning during loading operations provides an additional check on the grade of material trucked to the processing plant.

Underground exploration consists of drifts, crosscuts, and raises. Some long hole drilling is done with air-leg push drills and sectional steel. Flat holes up to 60 ft in length have been drilled with little or no trouble, but attempts to advance them at angles of over 20 deg upwards have not been successful as yet. The drill crew consists of two men, and footage drilled per hour averages 4 ft. In some sections of the mine drilling operations are carried on under very adverse conditions.

On the lower levels considerable diamond drilling is done in place of drifting and raising which, because of timbering required, is relatively high in cost. This is not true for the upper levels where the ground stands up well and lateral and horizontal openings can be advanced at a cost equal to or slightly above that for diamond drilling.

Principal underground development comprises the vertical Brown shaft, recently placed in operation, and five levels established at the 200, 300, 400, 600, 700 and 800-ft horizons. The last three serve as main haulage levels. Collar of the shaft is at an elevation of 4800 ft and its total depth is over 800 ft. The cross-section of the shaft is divided into two hoisting compartments, each 40x48 in. inside the timbers, and a manway. Shaft equipment includes a 65-ft steel headframe with two steel cylindrical ore storage bins. The 2-ton self-dumping skips are used with a double-drum electric hoist.

Shaft stations on the main haulage levels have slusher-trench pockets to speed hoisting of the sticky, clayey ore mined on the lower levels. (See p. 91)

The old two-compartment "M" shaft has been abandoned. And ore contained in the shaft pillar and near-by ground is being mined.

Mining methods in the new "G" pit are conventional. As mentioned previously, ore and waste are determined by 2½-in.x12-ft wagon drill holes drilled on 6-ft centers which are subsequently blasted as needed. Broken ore is loaded either by a ⅜-yd B-E 10-B gasoline shovel or a Drott TD-9 skid shovel into 6-yd International trucks for transportation to the processing plant about 1000 ft distant. Grade of pit ore averages 6 lb per ton.

Underground, in the upper zones where the ground stood up well, ore was mined by shrinkage and open square-set stoping methods. However, ground conditions on the lower levels require filling of stopes soon after mining is completed. Here, stopes are laid out for cut-and-fill with square-set timbering. Only a small section of ground is mined at a time. Under current plans, waste for fill will be bulldozed from the surface down a long waste pass to the 500 level, whence it will be distributed to the lower levels by tramming to respective raises.

Mining of the upper portion of the old "M" shaft pillar (500 to 300 level) is now in progress. The cut-and-fill with square-set timber method of stoping is employed. A set measures 5 x 5 ftx7½ ft high. Narrow slots three sets wide are advanced from footwall to hanging wall of the orebody. Procedure is to mine two floors of square-set and then fill two floors, keeping one floor open at all times. Slushing of ore and waste is done with 30-in. scrapers actuated by 7½-hp electric slusher hoists. Broken ore is passed by gravity or by scram drift and gravity to the 600 level for hoisting to the surface.

Most lateral development openings are advanced 6x8 ft in cross-section. Some sections require timbering. In extra heavy ground spring sets are used. Drilling equipment employed underground consists of Thor 380 push drills and I-R 38A stopers, using ⅞-in. hexagonal steel with Liddicoat one-use bits. Trojan 50% powder is used for blasting. Shaft rounds and large rounds in shrinkage stopes, at the time, were detonated electrically; but for all current work, blasting is done with fuse and caps.

Ore or waste broken in drifts and ore from draw points serving square-set stopes is loaded by Eimco 12-B's into 18- or 24-cu ft end-dump trucks.

On the main haulage levels ore

trains are trammed to the shaft slusher pockets by 1½-ton Mancha locomotives. Hand tramming is used on short hauls. Underground ore sent to the processing plant averages 13½ lb quicksilver per ton.

ROTARY COOLER has water spray to cut temperature of hot furnace-residue down to 100 deg F before it is discharged onto a 16-in. belt conveyor leading to waste.

Heart of the processing plant is the Pacific Foundry multiple hearth furnace in which mine and pit ore, previously crushed to minus 1 in., is burned to effect volatilization of the contained quicksilver. Auxiliary treatment units ahead of the furnace building include: a storage hopper equipped with grizzly and pan feeder which receives pit and underground ore delivered by 6-yd International trucks; a 100-ton coarse-ore bin with 30-in. Jeffrey vibrating feeder; a 10x20-in. Hendy-Tiger jaw crusher; and a 150-ton fine-ore bin. The units are connected by 30-in. and 14-in. belt conveyors. Transfer from the fine-ore bin to the top of the furnace is via a 10-in. belt equipped with a Hardinge constant weight feeder unit.

The furnace, fire brick insulated, is 14¼ ft in diameter and contains 13 hearths. These are divided into three treatment zones—namely, (1) drying, involving the three upper hearths; (2) burning, the following eight hearths; and (3) cooling, the two bottom hearths. The central shaft with its rabble arms revolves at 1 rpm. It requires about 20 min for the ore to travel from hearth No. 1, over hearth No. 13 and into the rotary calcine cooler. Burners using diesel oil as fuel are maintained on hearths 7, 8, and 9. Maximum furnace temperature is about 1300 deg F, and rock temperature is held at 1100 deg F. Fuel consumption averages 7½ gpt. The furnace handles 110 tpd.

Gases laden with quicksilver generated in the burning zone of the furnace and taken off hearth 4 pass successively through a 14-in. Sirocco dust collector and a multiple pipe condenser before entering a cast-iron pipe leading to a 48-in by 24-ft water-spray and baffle chamber at the base of a 24-ft stack.

Collected dust contains little quicksilver and goes to waste. Gases leave the collector at about 450 deg F.

The mercury condenser system consists of a series of three parallel rows of vertical cast-iron pipes 18 ft high. In each row there are 16 pipes, each measuring 12 in. in diameter. The pipes are connected on top by cast-iron U's and on the bottom by Y's of inclined cross pipes, the lower end of which dips into a water-filled concrete trough.

Tests with fiberglass pipes indicate that the material stands up well under temperatures up to 250 deg F and as a consequence it is planned to replace about 75% of the cast-iron pipes in the condenser system with these units.

The condenser system is under a positive vacuum of 7 to 8 in. Hg at all times. This is provided by a rubber-lined exhaust fan at the end of the condenser system. A second fan is installed ahead of the condenser.

Stack temperature is held under 100 deg F. This is important because stack losses increase with every degree of temperature rise. To prevent any undue rise, especially during summer, the last half of the condenser system is sprayed with water.

In the furnace department a novel feature is the use of a rotary calcine cooler in place of the conventional soaking pit below the discharge point of the furnace. The arrangement consists of a gas-tight steel hopper housing a feed scoop on the revolving cooler shell, a steel cooler shell, and a spray mechanism. The hot calcines are cooled to 100 deg F during the passage through the cooler prior to going to the waste pile via a 16-in belt conveyor 350 ft long.

Daily cleanup follows standard practice. Soot washed down the vertical condenser pipes is transferred in stoneware containers to a mechanical hoeing machine to which lime is added. The hoeing action causes the quicksilver to coalesce and subsequently run through a trap to a pressure filter. Here, the metal is forced by air pressure through a chamois skin into an agitator. In this vessel it is agitated with air and with a caustic bath on top for about 24 hr. From here the quicksilver is sent back to the pressure filter for a second filtering preparatory to being pumped to the bottling pot or tank. Cleaned metal is bottled in welded steel flasks, each holding 76 lb of quicksilver. Rejects from the hoeing machine are returned to the furnace.

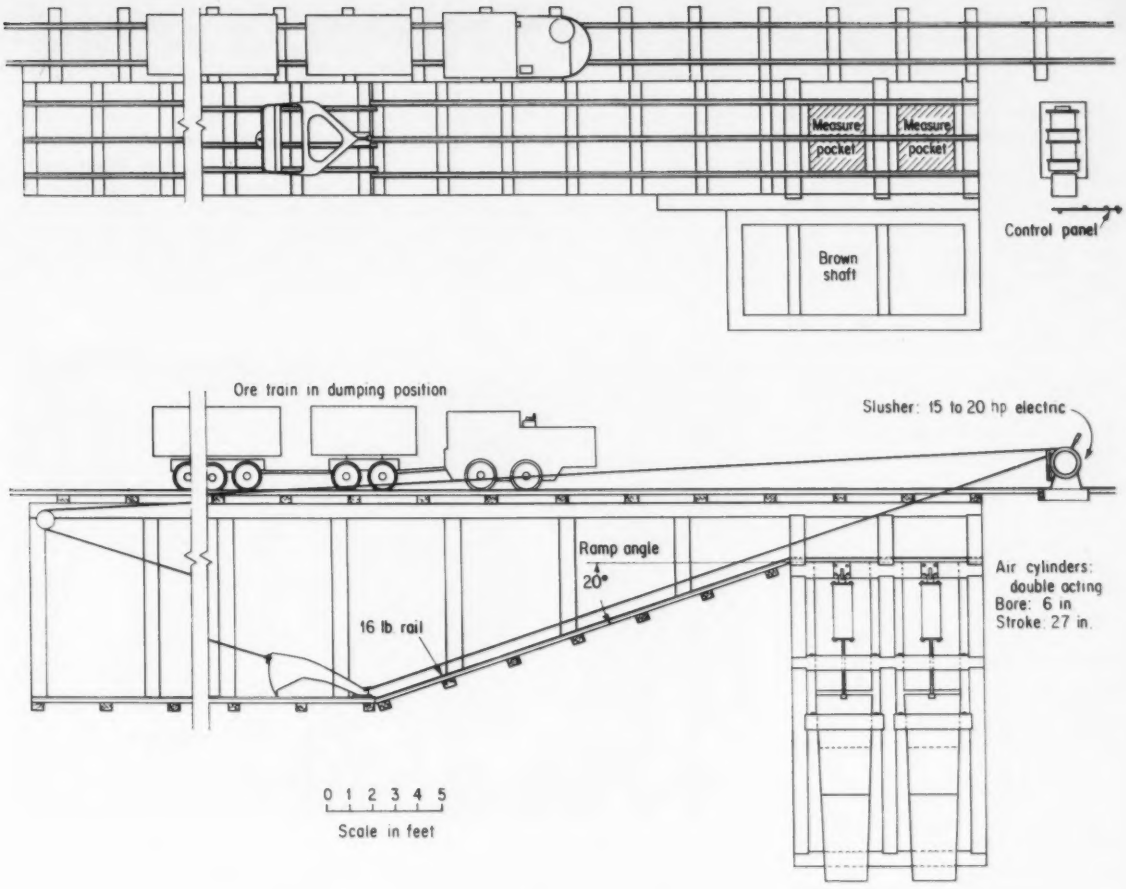
Overall recovery at the processing plant is rated at 96%. Less than 2% loss occurs in the tailings; stack loss is also below 2%; and remaining loss is unclassified. These losses are variable but easily held within the maximums by careful supervision of furnace and condenser operations. The control room serving the furnace and auxiliaries contains instruments for continuous recording of temperatures and vacuum.

The feeder on top of the furnace is equipped with an electric switch which activates a timer the instant ore feed is stopped for any reason. This time is accumulated and made part of the operator's records. It is interesting to note that during the past 5 yr ore has been feeding into the furnace for 96.5% of the total time in operation. The lost time accumulated included all major and minor repair shutdowns.

The electric powerhouse for the mine, plant, and camp contains diesel units: one 250-kw I-R, one 200-kw F-M, two 100- and one 85-kw Cat. Compressor equipment includes a 550-cfm C-P, (150 hp), a 500-cfm I-R and a 500-cfm G-D unit (both 125 hp) driven by Cat diesels.

Other surface plant facilities include a combination office and warehouse; repair shops; timber framing and carpenter shop; change rooms; bunk house for single men; restaurant; and housing for about 45 families. From 75 to 80 men, including the supervisory staff, are employed.

The authors thank S. H. Williston, vice president, Cordero Mining Co., Palo Alto, Calif., for his permission to publish the aforegoing article. Principle staff members at Cordero are: Bert Mitchell, superintendent; Elwin L. Fisk, mine engineer; Cliff Altig, mine foreman; Dale Anderson, plant foreman; and Jess Jaca, chief clerk.



Slusher Pockets Whip Sticky Ore Problem at Cordero

ELWIN L. FISK

SLUSHER TRENCHES rather than gravity pockets for skip loading have solved a difficult and time-consuming muck handling problem in hoisting sticky ore from the lower levels at Cordero. The skip tender operates the slusher and, from the same position close to the shaft, operates the measuring-loading chutes and signals to the hoist man. An air-operated vibrator on the loading chutes on one level further cuts muck sticking.

The layout shown in the accompanying drawing has worked so well since its adoption early in 1958 that mine operations could be reduced from a two-shift, 6-day basis to a one-shift, 5-day week basis without a cut in tonnage hoisted. Faced with fluctuating quicksilver prices, as well as wage, tax, and materials and equipment cost problems, the savings brought about by the change will help greatly in maintaining economic equilibrium in mine and plant operation.

Mr. Fisk is mine engineer for Cordero Mining Co. at McDermitt, Nevada.

The Problem

Below level 5 the ore is in highly altered rock containing considerable marcasite iron sulphide. The clay minerals left from this argillic alteration of the host rhyolite are very sticky when wet or even slightly moist. As a consequence, the clay presents a serious muck handling problem on the lower levels. Chutes have to be frequently picked down or blown out with blow pipes; and hung up gravity pockets require extra attention to keep them in flowing condition.

As an example of the problem that is faced, in the fall of 1956 it was decided to try a small gravity pocket on level 8 in the old M shaft in conjunction with a steep gravity ore pass raised at an angle of 74 deg from level 8 to level 7. Even though the ore did not build up to any great extent on the bottom of the raise, as was the case in openings of flatter inclination, the raise regularly plugged and slowed down operations. And the pocket was hung up so often that another man was added just to keep it blown down and freely flowing. Even with those changes, most of the ore had to be shoveled into the skip to prevent buildup.

The Answer

During this period work was in progress on the new three-compartment Brown shaft. In view of the experience gained in the M shaft, it was doubted that gravity pockets were the answer to bring about faster and more continuous ore handling on the lower levels. Instead, the suggestion was made to try a trench dump with a slusher to scrape ore into measuring pockets.

The installation now in use was designed in June 1956. The measuring pockets are of box construction, with an inclined guillotine gate undercutting the main part of the box. Each gate is operated by a 6-in. diameter air cylinder. A panel within easy reach of the slusher hoist contains controls for the air cylinders and push buttons to signal the skip hoist man.

No grizzlies are used over the slusher trench, chiefly because most ore recovered from the lower level comes from cut-and-fill square-set stopes and has already passed one grizzly. Furthermore, the rails on which the slusher bucket rides over the measuring pockets act as a grizzly. The rails also extend the full length of the trench and prevent the scraper from deepening the trench floor.

Each slusher trench is of a size to accommodate the load of a small ore train made up of 24-cu ft. end-dump cars. The hard packed clay in the trench is loosened and broken up as the scraper moves the ore from the trench up the ramp into the measuring pocket. Loosened material is not given a chance to pack or settle before it is dumped into the skip.

The Results

Some of the advantages offered by the installation include:

1. A complete ore train can be dumped without spotting individual cars as is done at a gravity pocket or ore pass.
2. Mechanical movement of ore eliminates time and labor expended on gravity pocket hangups.
3. The skip tender is at the loading station at all times and easily contracted by supervisory personnel.
4. The slusher-scraper cleans the storage trench, in contrast to the picking and blowing down operations necessary in all gravity pockets.
5. Installation can be designed to move any desired tonnage per hour.
6. Capacity of pocket can be increased by simply lengthening it.

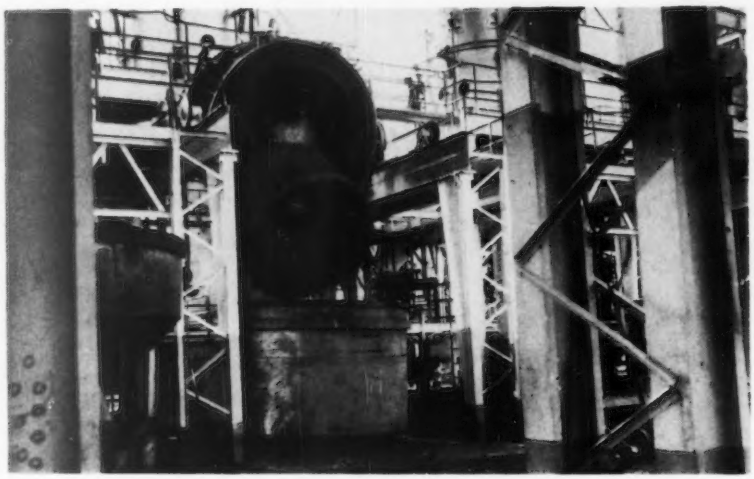
Principal disadvantages are: (1) a counterbalanced swinging door is required over measuring pockets to provide access to and exit from cages; and (2) the installation might be more difficult to maintain in badly squeezing ground.

Recent time and motion studies covering installations on levels 6 and 7 have disclosed the following averages from numerous timings:

On level 6 (about 500 ft below surface) the slusher consists of a 15-hp electric hoist and a 42-in. bucket. To fill the 49-cu ft pocket required 1 min 26 sec (4.6 scraper loads). Dumping and inspecting the pocket took 11 sec. Hoisting the loaded skip and returning the empty skip in the other compartment required 1 min 21 sec. During actual working time the skip tender pulled 110 tons in 2 hr 7 min or an average of 51 tons per hour.

On level 7 (some 600 ft below surface), a 20-hp electric slusher is used with a 36-in. scraper. To fill one pocket required 1 min (3.5 scraper loads). Dumping and inspecting the pocket was done in 8.5 sec. Hoisting time was 1 min 40 sec. During actual working time the skip tender pulled 60 tons in 60 min.

Actually, on level 7 material handled is usually much stickier than it was during this test and often hangs up in measuring pockets. Addition of an air-operated vibrator to the bottom back edge of the pocket appears to have overcome this difficulty and kept the efficiency high.



M. W. KELLOGG will build a 500-ton (output) direct reduction plant for Hojalata y Lamina, S. A. at Monterrey, Mexico based on the presently operating 200-ton unit.

HyL Process Yields Sponge Iron

IN THE FIERRO ESPONJA plant at Monterrey, Mexico, Durango iron ore is reduced in fixed-bed, batch reactors by direct gaseous reduction using a mixture of 85% hydrogen and carbon monoxide, plus carbon dioxide, methane and water vapor. Natural gas is reformed through an M. W. Kellogg high-pressure steam reformer.

Five reactors are operating on a reaction cycle of four hours (plus 30 minutes dumping time) by one operating crew. One reactor is dumped every hour. Ore, sized from 1½ to ¼ in., is treated in 15-ton batches (200 tpd output). About 21,000 cubic ft of natural gas is needed per batch. Final reduction takes place between 1600 and 1900 deg F. Reduced product retains its approximate size, but has become porous, and is discharged to a hopper for transportation to the melting furnace.

Reactors are of special design with an arrangement that permits the bottom (ore holding) section of the furnace to be detached readily.

Average ore assays 66.6% Fe, 0.008% P, 0.02% S, and 4.5% insol, while the average sponge iron assay is 86% metallic iron, 90% total iron, 0.62% C, 0.07% S and 8% insol. Total reduction of iron is 95.5%. Sponge yields exceptionally high quality steel in the electric furnace. Finished as sheet, it can undergo difficult deep drawing applications. This has become another important advantage of direct reduced iron—low range of tramp impurities permits deep drawing. Steel made from scrap sometimes has too much tramp to permit deep drawing.

Kellogg is designing a 500 tpd (output) facility for Hojalata y Lamina, parent company for Fierro Esponja. Estimated cost in dollars per ton of steel in a 1,000-tpd facility on the Gulf Coast is $34.43 including maintenance and capital charges of 20% of plant cost, according to M. W. Kellogg.

A film showing the Fierro Esponja plant in operation is available from the manager, metallurgical & process industries, M. W. Kellogg Co., 711 3rd Ave., New York 17, N. Y.

Mining Practice: Part II

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Associate Editor

[Part I, in February, presented a number of trends and methods in surface and underground mining. In this second part more details are given on breaking, ground control, muckhandling and auxiliary subjects for both open pit and underground production.]

Breaking

All-mechanical means of breaking and opening ground have been partially detailed in Part I: on surface, tractor rippers; underground, "mechanical moles." The remote-controlled continuous miner that was mentioned is a boring type that continuously scrapes concentric grooves and breaks the lands by an outward pressure of sliding wedging elements. Other types are expected to be developed. A cable box is used for control (CMIA Mtg58). Cutting-resistance and radioactivity sensing devices are being considered for more fully automatic control.

The coal-plow type mechanical miner was briefly mentioned as being applied to harder rocks. The approach has been to get penetration at feasible thrusts by applying a percussion mechanism to the teeth along the cutting edge of the "planer," e.g., phosphate rock in Montana and coal in Germany (*E&MJ* Jul 56).

For underground drift mining of placer gold, a highly efficient, small bucketline excavator was recently developed by Amo Placer Mines Inc., Oroville, Calif. It is used with belt conveying.

Hydraulic breaking and excavation, also briefly mentioned in Part I, has long been a cheap means of achieving single step excavating and transporting in placer-type surface deposits. Recently, powerful water jets were placed on the head of a suction dredge to aid digging. The underground application to soft dike material containing Pb-Zn-Ag uses a standard nozzle and pressure. In coal, nozzles are more or less standard but pressures of 500 to 1500 psi are being used. In gilsonite a special apparatus was developed. Tiny nozzles (under ½-in. openings) and 2,000 psi pressures are used. Nozzles are mounted on hydraulic booms carried on a tractor.

For breaking in open pits by conventional drilling and blasting, the trend toward large holes and non-vertical holes was covered in Part I.

For drilling large inclined down holes and off-horizontal holes, rotary and down-the-hole percussion drills are promising. Until now such holes have generally been drilled with large standard hammer drills which limited holes to abut 6-in dia. Peabody Coal and Joy are working on a horizontal adaptation of a large vertical air-flush rotary. The first model was a 55-ton crawler rig that drilled plus 9-in. holes to 48 ft in one pass. In spite of the weight, thrust may be a problem in hard ground. Peabody is aiming for a machine which will drill 150 ft deep.

Down-the-hole percussion units with the new 9-in. bit make large and long angle holes feasible, especially in hard, ragged rock. Thrust and energy loss in the drill rod is practically eliminated. The weakness of large TC inserts was an obstacle to the large bit but apparently I-R overcame it. For 4½- to 6½-in. bit size units, Mission Mfg. has an X-bit with only a chisel in the center area. This cuts over-grinding energy losses that are inherent at the center of bits.

For large vertical down-holes—4- to over 12-in.—fast rotary roller-cone airflush electric drills are the first choice of most operators. Diesel models are common too. While capital costs may keep churn drilling in the picture for some time, rotaries can drill 2 to 8 times the footage per shift and give lower over-all costs. Carbide-button roller-cone bits make rotary drilling feasible in the hardest rock; but in wet, ragged and hard ground the down the hole percussion drill is probably better—Ingersoll-Rand offers a 9-in. bit size now. Of course, in very hard quartz-bearing rock the flame jet-piercer is still best.

A down-the-hole air-percussion mechanism with a roller-cone bit was introduced this year (Junction Bit). It reportedly doubles the speed of plain rotary drilling.

An air-flush rotary driven through a chain and gears directly from the tractor engine is proving superior to air-rotated units in Alabama coal sediments (Robbins Coal).

The principal bit-life problem with roller-cone bits is exposure and failure of the cone bearings. This is less critical in larger bits. A number of operators add life by retipping teeth and rebuilding gage surfaces with hardfacing material. One bit is designed with a large overhang, a thick body and replaceable cones which can be run to destruction.

For soft rock, there is a new bit having coarse-toothed cones which are mounted slightly secant-wise to give a twisting gouging action.

Wet ground is an obstacle to air-flush drilling but in oil exploration a recent answer is liquid sealants that rapidly gel.

Dust is sometimes objected to in air-flushing. Cyclone and other collectors have not been well received. Some operators inject a little water into the air—often disconnecting the collector—and let the cuttings pile-up around the collar.

For medium hard and soft rock there is a variety of rugged auger equipment for drag bit drilling of any size and inclination of hole. But long holes tend to curve. U.S. Borax augers 4⅝-in. vertical holes and at least one Minnesota iron pit is testing a horizontal 6-in. unit. Hardfacing the edge of the scrolls cuts wear costs as do bits with easily replaceable TC insets.

Small holes (minus 5-in.) are still needed in bench development and evening bottom or for toe-holes at even the largest pits. Small pits use them for all production. For such work the highly maneuverable, self-propelled crawler wagons are outstanding. They mount large air drifters and have integral or towed diesel air-compressors. Standard percussion hammer types are most common but small down-the-hole percussion units are available and in Europe rotary percussion machines are widely used.

For similar work, Atlas Copco's "bencher" mounting for a percussion drifter is a new intermediate alternative to hand-held and wagon-, skid- or tripod-mounted machines. The 90-lb mounting consists of a 7-ft air cylinder with a drill-yoke attached to the piston rod, and a short anchor pin. It permits one man to operate two drills and get 750 ft per shift. The pin hole is drilled with a small sinker and the pin is wedged in place. Near the head of the pin is a slot and below the slot is a fixed collar which has a cylindrical upper surface. On the bottom of the air cylinder (the end opposite the piston rod) a short pipe-stub is affixed transversely. It is slotted circumferentially which allows it to fit over the pin head and rest in the curved surface and rotate. A wedge is driven through the slot in the pin head and thus

holds the cylinder rigidly even at slight inclinations.

Regarding other schemes of drilling, various down-the-hole turbine-rotary and percussion devices (both unbalanced weight and magneto-strictive types) are being tested in oil drilling. But except for the last one they are mud activated and of doubtful use in mining. Likewise, except for the thermal jet-piercer and possibly the electromagnetic device (mentioned in Part I), other means such as chemical and sonic vibration (direct or of an abrasive slurry), must be relegated to the far future (AIME Mtg 58, Simon).

For secondary drilling, the various drill booms and arms and drilling platforms on booms, which are mounted on tractors and other vehicles, have established themselves as cost-cutters. One new wrinkle on this practice is to clamp a drill on the bucket of an idle shovel. Blockholing costs were also knocked for a loop in Africa by a tiny 7-lb percussion drill which rapidly drills 1x8-in holes (Cons. Pneum.). For boulders that can be set aside, there are plenty of quarries and pits that still swear by the crane and dropball for lowest costs.

Blasting in pits continues to be shaken most by ammonium nitrate agents. Low cost (as little as a third of dynamites), very safe (handle as if gasoline), and wide application (gives same results as 50% dynamite) are the advantages. Prilled fertilizer grade AN mixed with 6% by weight of No. 2 diesel oil (1 pt per 10 lb) is probably the best general purpose recipe. It can be prepared concurrently with pouring into the hole or it can be premixed and packaged. Premixing gives a more uniform and intimate mix that is more reliable and powerful. Water is considered a poor environment for AN agents but is most commonly solved by waterproof packaging. Plastic bags can expand to fill the hole. The other major disadvantage of AN agents is the need for a more sensitive and powerful explosive as a primer and for spaced boosters to start and insure propagation of the reaction, although actually just two 1½x8-in. sticks of 50% gelatin dynamite has worked as a single primer-booster. This and the water problem are being tackled by several companies.

The 65% prilled AN-20% granular TNT-15% water, explosive slurry developed at Iron Ore of Canada is the newest answer to wet holes (MSMSym 58). It is also more powerful than the more common AN mixes and thus is useful in special dry work. The pea-soup-like, 1.4-Sp.G. material can be poured or blown into the hole; although in standing water, segregation should be avoided by using a pipe or hose to the bottom. It is being patented and will be available from explosive makers as a packaged item; but it apparently could be mixed in the field. Material costs at IOC were 7¾c per lb as against 4½c for AN-oil but mining costs were cheaper because spacing and burden can be increased to 1½ times. A low cost, 6-oz cast pentolite primer-booster was also developed by IOC for both slurry and regular AN-oil blasting. They slip on the detonating fuse and are spaced through the charge.

Removing water from the hole just prior to charging followed by quick detonation is another way of accommodating AN to wet holes. Fast acting blowers and down-hole pumps are used. A steam jenny and calcium chloride are used when ice forms at Reserve Mining—although they prefer to leave known wet areas for dry-season summer work. Some operators find water filled holes are no problem if AN-oil is carefully placed on the bottom with a pipe. Still others wonder why there is a problem—"just pour it in and add a little crushed stone to sink it" (N.T. Trap Rock). Apparently the main requirement is to prevent the prills from being surrounded by water or leached out by running water—the outer particles probably cake up and form a slightly water-impervious shell.

By dusting-off about nine-tenths of the normal 4% inert anti-caking coating on AN prills, Hanna Coal found a more sensitive, powerful and reliable agent resulted. Placed in a waterproof bag, a 20-lb portion mixed with only 2% by weight of oil makes a priming charge that can be detonated by a close, tight, six-turn wrap of 60-gr detonating fuse. For the main charge, a 6% oil mix is used because it is a third more powerful but less sensitive.

Prilled fertilizer AN without inert coating but with a special surface treatment that prevents caking was offered this fall by Spencer Chemical. It is packed in a polyethylene bag. A 94/6 mix can be set off with a single strand of 150 gr detonating fuse.

Oil heavier than No. 2 is preferred by Maumee Collieries because it leaks and evaporates less and has a higher heat content for more power. They also prefer chemical grade AN, which is denser and gives a higher velocity, and machine premixing and packaging.

Liquid oxygen-carbon explosive has a cost comparable to AN-oil but its brisance is considerably greater. The recent development of Nerex, a new absorbent carbon, improves its safety aspects. It may offer an advantage in the pits where large quantities of oxygen are also used for jet piercing since oxygen costs are based on consumption rate.

Conventional explosive developments include tapered-end packaging for easier loading, various gimmicks for attaching detonating fuse and for inserting detonators quickly, as well as hooks and tapes for lowering, and longer cartridges.

Detonating fuses now come in a variety of sizes, tensile strengths, water-resistances and prices. Igniting fuses have several speeds for timing and one works in water. Both metal and plastic connectors cut labor time.

Charging machines are a recent labor-saving development. Most of them are only suitable for loading loose powder, especially AN-oil and especially in vertical down holes (*E&MJ* Oct 58). Simple hand-carried or rear-of-truck-mounted gravity funnels with spray-nozzles near the outlet are widely used. Several schemes are used to meter the oil. A tilting box on the truck bed is an innovation of Utah Construction which permits using unbagged AN. The box is filled from an elevated bin. Kennecott dusted off an old pneumatic unit which was adapted to feed oil into the flowing AN as it passes from the hose into the hole charging pipe. It is very successful for loading 3-in. toe-holes.

A pneumatic charging scheme using a blower fed by a screw conveyor in the bottom of a V-hopper tank truck has been developed at IOC to load AN-oil which is premixed at a large bulk plant at the mine site.

For loading small stick dynamite into holes, at least two air devices are commercially available. And for packaged explosives of larger size, a tractor-mounted, pole-type loader-tamper for horizontal holes was developed by Peabody Coal (*CA* Sept. 57). It uses rubber friction wheels to move the pole back and forth. The pole is sectionalized, has automatic couplers and is fed from a large square reel.

Stemming plugs are finding favor as a quick means of increasing confinement to get full power. Peabody Coal reports using one made of asbestos cement with a plaster center. A wood plug is available which has a self-wedging design, yet it can be easily removed if necessary. Other types are being tested. Even old bowling pins were found effective

and inexpensive on the Niagara Project.

Blasting techniques are making wide use of millisecond delay caps and connectors to cut useless vibration and increase fragmentation. Some blasters like shooting against a muck pile as a simple way of further increasing fragmentation. And, as mentioned before, inclined holes can concentrate the breaking effect in hard layers. It is not quite clear whether the trend toward concentrating explosive at greater spacing, i.e., larger holes and coyote tunnels, means fragmentation is just as good as with small, distributed charges, or whether the bigger equipment being used can accommodate larger boulders at lower over-all costs. Some recent blasting theory tends to favor the first approach (ColoSym 56).

Large single blasts are a trend. Some have been mentioned (Part I: Nuclear Blasting). An unconfirmed report from China says a 10,000-ton blast has been made in mining. In January 1958 Morrison-Knudsen is said to have made a coyote blast of just over 1,000-tons—80% bagged Amocol, 20% 60%-dynamite. It was a record breaker that broke something like 4-million tons of fill rock for a causeway across Great Salt Lake in Utah.

For secondary blasting by mudcapping, the flexible, flat sheet explosive that Dupont recently announced is an efficient agent. (D&B Sym UMinn58, Huber). But since the explosive is basically PETN, its cost might be prohibitive.

In underground breaking by conventional drilling and blasting, longer holes and larger holes are also a trend, see Part I.

For drilling, the percussion machine has long been king in hard rock. But rotary drilling is faster and inherently more efficient (D&BSym UMinn56, Lacabanne), and is finding increasingly wider use in medium-hard and soft rock—drag bits are usually used, often with auger steel. Rotary-percussion drilling has been shown to be a means of gaining the faster penetration of rotary drilling without the excessive thrust (and associated bit wear) that is required in hard rock. Nevertheless, rotary-percussion has not made much impression on U.S. practice so far. The machines have been objected to on grounds of high air consumption; and even converting the rotary mechanism to hydraulic power has not stimulated much interest. Such machines, of course, require higher thrusts than are normal for straight percussion. In Europe, on the other hand, r-p continues to gain in popularity.

Practice has established the airleg-mounted, lightweight percussion machine as the ideal tool where there is limited working room and difficult access. The newer lightweight stopers with rigidly attached airlegs are undoubtedly the best machine for short up holes. For near-horizontal holes, machines that are hinged to the airleg can be used on small holes up to 60 ft long. The fairly new ¾-in. hex steel is proving particularly advantageous on such long hole work. The universal type coupling between machine and airleg has made single units more universally applicable.

In Outokumpu, Finland, a universal airleg machine is used for downholes by arranging the airleg like a stoper and then chaining it down to a short anchor bolt. The machine is a 44-lb Tampella T10C which has attracted attention because it uses grooves and ports rather than conventional valves for internal air flow. In addition, the piston is fat with a short, fast stroke (4-in. dia, 1¼-in. strokes at 3,500 per minute).

The "Bencher" mentioned for open pit drilling of small down holes is also feasible for underground work.

The drifter type percussion machines—now up to 4½-in. dia cylinder size—are faster and more efficient for larger and longer holes at any angle. Aluminum feed-shells, both chain and screw type, come 12 or more feet long. Where access is difficult, as for 150-ft ring drilling from sublevels or raises, arm-and-post mountings can be used; for down holes alone, tripod and horse mountings are useful; and in shafts, umbrella-like rope-suspended jumbos are widely used. But where access permits, crawler or wheeled jumbos with hydraulic booms rapidly orient and firmly support the machines for superior results.

Use of a surface model down-the-hole percussion drill as a large hole drifter was mentioned in Part I. The tremendous loss of energy in conventional systems—70 to 90% between that in the hammer and that delivered to the rock (AMC Mtg57, Anderson)—will undoubtedly stimulate further development of down-the-hole systems. Of course, much can also be done with current systems.

Drill steel has been highly perfected as to life and energy transmission in recent years, yet continues to be the subject for considerable research (*E&MJ* Nov 57). Alloy steel with high as-rolled-hardness has been used for some time. It demands careful heat treatment in fabrication and avoidance of physical damage to the surface in use. More recently, case hardened rods have proved their superior qualities—especially for sectional longhole rods. Metallurgical treatments, particularly carburizing, is the means commonly used. Such treatment is not suitable for mine site use and refabrication of such rods is of doubtful advantage. Mechanical surface-hardening is also used, e.g., shot peening generally follows carburizing at the factory. A mine site scheme of cold-rolling to impress spiral grooves also raises rod life, especially rods that do not have protruding collars or shoulders.

The retaining collar on the shank of drill steel can be eliminated by pressing on a short, rubber-lined steel sleeve. But the lugs on round steel remain a problem. A simple conical, friction held shank is successfully used on the German rotary-percussion machine. The bit shoulder can be eliminated by using a conical connection too.

The water hole has been found to be the site of many drill steel failures. A water environment has a great weakening effect on steel, especially if the steel is pitted. Smooth holes and chemical coatings are answers. And a chrome-steel lining is available on a British steel. Air-flushing is another answer.

The integral bit and rod is a highly efficient tool on short holes. Some of its advantages still apply on holes up to 32 ft when using a flexible, ½x1-in. rectangular rod—it can be safely bent in a 7-ft-radius curve.

For connecting bit-to-rod and rod-to-rod in percussion drilling, the simplest device is the conical friction attachment. Taper angle of 3 deg has been objected to as being insecure, 12 deg as increasing male end breakage. The use of brass or copper shims raises a supply problem. Sticking of steel caused by cuttings collecting at the skirt edge can be solved by grooving the male surface to form a flushing-medium outlet (German patent). Conical couplings have also been used to reclaim broken integral and threaded steel.

But the efficiency of transferring impact through a friction surface is questionable. A recent study (*MsM* Jun 59) indicates that a connection which bottoms against the next component in the drill string and which has a rip-saw tooth type of reverse-buttress thread, transfers energy better and requires least effort in disconnecting. (Unfortunately, the rope-like-threaded connection was not tested.) A bridgeless type of sectional rod coupling would thus appear best;

but to insure an equal, balanced joint, a semi-bridge type is probably most practical.

Percussion bit life and penetrating efficiency has been raised to very high levels by the use of tungsten carbide inserts. Their gage-preserving quality has also promoted long hole drilling. The use-to-destruction, shallow TC insert, slip-on bit was a recent innovation. A design recently patented employs a wedge shaped insert so that more hard metal is exposed by wear and sharpening.

The ultra hard ceramic-metal alloys hold much promise as inserts; but the inherent brittleness of all hard materials is an obstacle. Some of these synthetic materials have qualities that make them superior to diamonds; and if their cost can be reduced they may create a new interest in rotary drilling of very hard rock with diamond-type bits.

Percussion bit design is being improved in other ways (*E&MJ* Mid-Jun56). The wedge seems to be the most efficient shape for penetrating and breaking rock—a less than 90 deg wedge is best but wear and strength considerations in hard rock make an angle on the order of 115 deg more practical (*ME* Jan59). The cross-bit has been claimed to have a number of advantages over the chisel-bit, although sharpening is somewhat more difficult (*E&MJ* Oct 56). The pilot-and-reamer style of bit appears to have certain prestressing and pre-cracking characteristics that make it more advantageous than a flat-face-cutting design. The inherent over-grinding loss of energy at the center of all bits has been overcome by removing the center fourth of a chisel bit—resulting in a one-third increase in drilling speed (*E&MJ* Oct56).

On many bits, a larger chipway area permits coarser cuttings to escape from the bit face. Such design also cuts a bottleneck to fast fluid flow. More and larger flushing-medium inlet ducts also help. But, since the ability of a fluid to move heavier and larger particles increases with fluid velocity and since for a given rate of flow a smaller area increases velocity, a "reverse flow" up the centerhole is attractive.

Flushing with air has several advantages (*E&MJ* Jul55). For one thing, it facilitates reverse flow flushing. Collection of the dust has been an obstacle and reverse flow simplifies this. This year there have been a number of new simple air-flush percussion systems put on the market (*E&MJ* NPD).

In rotary drilling, the machines are of simple and efficient design. Air-operated units are perhaps most common. Electric units are especially efficient—the more powerful models frequently have an intermediate hydraulic drive for simple rotational speed control and to absorb shock. The high thrusts and rotary torque require fairly rigid mountings. Column-and arm is the normal set-up but the newer high-thrust electro-hydraulic machines use hydraulic booms on a mobile carrier.

Drill steel for rotary work in soft material is usually an auger type. Hardfaced scroll edges cut wear. Connections for detachable bits and for sectional rods are of several types with the male-to-female arrangement, using a spring-loaded button and hole as a locking device, finding favor. But bits are frequently locked on tightly with a cotter pin to prevent chatter from damaging TC inserted bits.

Drag bits for softer ground are two- or three-prong types with tungsten carbide inserts. In hard ground, the spade type is stronger; and, as for the percussion bit, a small notch in the center greatly increases penetration speed. Bits for softer ground have sharp wedge angles with positive axial and radial rakes to speed penetration through a coarser chipping action. Likewise, the pilot style bit is faster than a flat face cutting style. Thus the eccentric spiral and the concentric stepped-ring Christmas-tree style bits are fast and efficient. Roller cone bits are also being used for large holes.

Rotary-percussion drills from Germany are fairly heavy and powerful units that require rather substantial mountings. The steel is round with conical male taper at both ends. Machine chuck, couplings and bits have female sockets. Bit design is a compromise between a percussion chisel and a rotary spade—having a large cutting wedge angle and large negative rakes.

A down-the-hole percussion compressed-air drill of jack-hammer size was recently offered (*E&MJ* June57 NPD.) It can drill up to 35 ft.

Other schemes for drilling rock, as mentioned in pit drilling, remain far on the horizon.

The use of chemicals in the flushing water continues to crop up in literature. Rock softening agents, rust inhibitors and deflocculants have been suggested. The latter would reduce the basic carrying requirement of the water.

Blasting underground took a giant step toward lower costs last spring when Eagle Picher successfully used ammonium nitrate-fuel oil in the Tri-state district (AMC Mtg58, Elizondo). International Minerals & Chemical Corp. also has proven the application underground in potash.

Eagle-Picher, in 2½-in.x10-ft dry holes, used 1¾ x 16-in. waxed paper cartridges of uncoated fertilizer prills and No. 2 diesel oil (8 pints per 100 lb). The mix was tumbled in a wooden barrel and packaged by hand. One stick of 1¼x8-in. 60% ammonia dynamite was used after the bottom cartridge and one was used after every second cartridge thereafter; detonation was with one strand of 50 grain detonating fuse laced through the bottom dynamite cartridge and running along the side of the hole for its full length. No change in powder factor or spacing was made. Fumes were found better than with dynamite.

At Kiruna in Sweden, "Imatrex"—a cast cylinder of potassium chlorate soaked in kerosene—is a locally compounded explosive that is catching attention. Advantages cited are: no toxic or odorous fumes, high density, non-deteriorating, and insensitivity to temperature.

Conventional explosives now come in long cartridges to speed charging, although tamping is probably less effective in getting good hole density. Cartridges up to 5 ft long are used in Sweden.

As mentioned in surface blasting, a wide variety of detonating and igniting fuses are available, and millisecond delay caps and connectors are widely used.

Pneumatic charging guns for stick explosive are available; but some operators feel the impact of the sticks is too hazardous. One model has been used in Sweden for several years. At the Skorovas mine in Norway loose dynamite is used. For charging long holes operators are using loading-tamping sticks made of plastic hose, aluminum tubing and other materials. The rigid materials are generally designed for quick coupling.

A pneumatic stemming gun for underground use has been announced in Germany. It is said to extrude and place fifty 3-ft slugs of stone dust and water (Sp.G 2) in seven minutes. In Russia a one-13-lb-shot air stemming gun made of sheet metal is in use.

Stemming plugs made of cement, wood, or scrap asbestos paper are finding wider use as a fast means of increasing confinement. One small wood plug, introduced this past year, has an expanding-wedge effect under explosion pressure yet can easily be removed if necessary.

As an alternative to conventional stemming, and even tamping, the high pressure "pulsed water infusion" scheme used for dust suppression in coal mines is creating interest in Europe. Water not only aids the mechanics but also raises the strength of the chemical reaction.

Missed holes or bootlegs are often a serious problem in blasting. For the case where an electric cap is still in the hole, detonation by radio waves was reported under test. Another problem is locating undetonated explosive in the muck. Canadians have tested radioactive isotopes in the powder but the results and costs do not seem favorable.

For secondary blasting, these are some recent field-proven ideas: to reach ore pass hang-ups, explosive is emplaced by pushing up through a plastic tube assembled from 10-ft sections; to block-hole in ore-pass hang-ups, pipe sections are used to extend the stinger on stopers; for block-holing on grizzlies, the small percussion drills are handy.

Ground Control

Ground-control in pits becomes a problem as they get deeper. Slope angles must accommodate the particular ground conditions, but they cannot be accurately calculated as yet. A cup-shaped pit has been suggested as the design of the future (*MCJ* Aug58). Drainage must be given careful consideration since water lubricates particles, generates pore pressure and acts as a wedging and fracturing force when it freezes and thaws. Solidification of weak ground can be tackled with gels or grouts. Gels and grouts can seal off water too. Semi-permanent slopes can be strengthened with pins or rock bolts. Channels and chain-link fencing can be used, too.

Underground, artificial ground support is the principal means of ground control (see *E&MJ* Feb &Mid-Jun 57). A guiding rule is to get support in quickly to restrict movement, cracking and caving.

Rock bolts have been an almost universal panacea. They prevent loose from forming by counter-stressing the ground, form natural arches by pressing and pinning chunks together, tack large chunks to solid rock, and produce a thick laminated beam in layered rock. Where the face of the rock is generally incoherent they are used with various bars or wire mesh.

A 3- to 5-ft rectangular pattern of 5- to 6-ft bolts is common. The expansion-shell type of ¾-in. steel bolt is probably more popular than the slot-and-wedge type. Wood bolts are still favored by some mines where corrosion is a problem. The ⅝-in. high strength steel expansion-shell bolt is rapidly being adopted. Bolthead and nut-head types are available.

Aluminum expansion-shell bolts have been used on Alcan's Chute-de-Passes tunnel. They are 6 to 12 ft long, made of 1¼-in. bar stock 65 ST Alloy. The result is a lightweight, easily handled, corrosion-proof bolt.

Another new bolt has a frangible tube of quick-setting resin on the end of the expansion shell. It increases anchorage in soft ground.

The portland cement grout anchored bolt is popular in Europe for more permanent openings. A perforated metal tube for the grout eliminates the need for a grout pump.

Special stopers are available for rapid rock-bolting. Standard types of stopers with reverse rotation or bolts with left hand threads permit one machine to be used for both drilling and tightening. Since the machine can be set for a fairly constant torque, they insure better anchorage and tensioning.

Visual tension-indicators are coming into wider use. They insure proper installation and show any changes. Thus they reduce the need for spot-checking with torque wrenches or jacks. One type is a dished steel plate washer which flattens according to the tension. Another is a rubber washer which changes in outside diameter.

Re-use of bolts seems to be increasing. Recovery and straightening apparently is worth the effort. A small cart has been developed for such work. (USBM *RI 5408 & IC 7826*)

Roof sewing, using old wire rope grouted in place is a Scandinavian practice (*E&MJ* Sep56).

For tunneling, a new scheme is to pre-bolt from a pilot drift and then strip. It involves drilling holes about 6 ft deeper than the final outline of the tunnel, followed by grouting 6-ft bolts into place at the bottom.

Recoverable yieldable steel props are of increasing interest for temporary support. Hydraulic and wedge types are available. Hinged roof bars are a supplementary aid widely used in coal. The self-advancing hydraulic prop-bars are attracting attention in Europe.

For frame type support, prestressed and pre-cast lightweight concrete set-members have been cropping up more frequently (*E&MJ* Sep56; USBM *IC 7858*). For semi-permanent support in squeezing ground, the yieldable steel arch and full circle sets continue to prove their cost savings. Several weights are now available.

For continuous permanent support, massive concrete has no real equal. Actually, concrete resists blasting vibration best when unreinforced. Lightweight concrete and prefabricated sectional forms simplify construction. Floors are usually poured first as a base. Often wheeled carriages can be used to support and move collapsible arch forms. In South Africa, a full rectangular collapsible form 12 ft long is supported by two cantilever beams on a wagon (*E&MJ* Dec57).

To cut air-slaking of rock surfaces, portland cement grout is widely used as a spray coat. Chemical gels are also proving useful in underground storage chambers. Synthetic rubbers and resins have also been tried but seem too costly.

To solidify and seal weakly-bonded and wet ground, the drillhole injection of chemical gels is proving highly successful. They can be injected more easily, travel further, and set more quickly than portland cement grout.

To bond layered rock, quick-setting resins have also been tested; and while remarkably strong, the cost is still high.

For ground support in stopes, the wide use of hydraulically placed mill-tailings fill was discussed in Part I. Deflocculants are an aid to fast drainage and settling where slimes are difficult to remove. The growing interest in pneumatic stowing was also mentioned in Part I. At the Essen Fair, a revolver-like air-gun was displayed as a high-rate placer with relatively low air consumption.

Use of steel mesh as a flexible mat in caving methods of mining was likewise mentioned in Part I. It is said to be used in hydraulic mining of coal in Russia.

High pressure and rock burst problems have stimulated considerable research into ground control. Such work is developing principles that are applicable to support and control in general—in spite of the very great variation in rock properties and structural arrangements. Pressure measurements, physical property tests, and theoretical studies on the stability of openings are being conducted by many groups. Many of the findings are being reported at symposium and meetings, e.g., Colo Sym, AIME, CIMM. Instrumentation has been greatly improved (E&MJ Oct58; ColoSym 57) and model studies are being perfected (USBM RI's; Leipzig Rock Pressure

Conf 58). While only a few results have had immediate practical use, the tempo of research should soon change that situation. These are some findings:

A rise in the rate of closure or of microseismic activity, both of which can be easily measured, indicates an approaching failure. An elliptical cross-section for openings not only has a natural arch strength but also will minimize stress concentrations if the major axis is aligned with the major stress. Strong horizontal support of openings in which sidewalls tend to fail and slough off, prevent the vertical support from becoming overloaded. Many openings are surrounded by a zone of destressed fractured ground in which stress gradually builds up through particle friction until a natural arch is formed; thus support must only carry the material within the arch.

There seem to be five general ground conditions:

Where ground is fully self-supporting—only some superfical "loose" produced in blasting must be supported or removed.

Where ground spalls or swells due to contact with air or moisture—surface coatings may prevent it.

Where ground acts like a pile of irregular, interlocking blocks—support or shape of opening must develop a stable natural arch or beam.

Where ground flows more or less as a plastic material—no permanent stable opening can be expected and supports must be yieldable.

Where rock-bursts or bumps are common, it has been found advantageous to insure that a relaxed zone of fractured rock surrounds all openings. This de-stressing can be accomplished by drilling and blasting in the solid face, or in some cases even by just drilling large holes. The incidence of bursts can also be reduced by avoiding isolated or projecting pillars. Siting shafts in destressed zones or off the strike-ends of the orebody avoids pressure problems, too (*KGF Bull 89*).

Muckhandling

Muckhandling in pits has been partially covered in Part I but there are other developments.

As a standard mucker the 8-yd electric shovel is coming to the fore. A number of operators are eyeing the frequent use of 10-yd units in coal. A 13-yd unit is reported being used to strip Kennecott Copper's Chino pit. Even diesel units have reached the 6-yd size this year. Apparently the larger shovels can do anything a smaller one can and do it faster.

In cold climates, IOC and Gunnar Mines electrically heat the shovel booms to reduce brittleness. New wide teeth with more sloping sides are another item that gives a cleaner job and cuts digging resistance.

Front-end loaders are moving more and more muck at smaller pits and are a handy help in larger pits. Wheeled units are especially mobile.

The standard truck now seems to be jumping up from the 22-ton to the 35-40-ton rear dump with 300-400 hp and a torque converter. Some 50-tonners are being used. The few larger units are semi-trailer types, e.g. Eagle Mountain's 65-ton rear dump. Tires amount to about one-third of operating costs and are the biggest problem. Deep treads plus metal and nylon reinforcing are offered as partial solutions. Better cooling systems, air cleaners and brakes as well as other mechanical improvements have been coming along.

Positive ejection type of rear-dumps give controlled discharge and do not require pans as structurally heavy as tilting dumps. Side dumps and bottom dumps permit one way hauls through the dump.

Aluminum bodies are showing up more and more in an effort to cut dead weight. Exhaust-heated pans cut freezing and sticking of wet muck.

For more flexible haulage and smaller pits, the 1- to 12-ton shuttle-dumps serve well. An unusual dump truck in which the rock-box is detachable has been in the news recently. It might be useful in a small pit where filling time is long and the truck could be released for other work or serve multiple digging points. One model has two masts for picking the box up; another is a fork-lift type.

Haul roads for trucks are an important cost factor. Hard, smooth and dustless surfaces together with gradual grades and wide pavements have been found to give appreciable savings in the long run.

In rail haulage, remote control switching and mechanized track work hold costs down. Diesel locomotives cut electrification requirements and seem preferable for long, permanent, fairly level hauls. Many clever tools for track work have been noted in the literature, e.g., a boom on a tractor for moving trolley wire towers and a cradle on the dozer blade for lifting either the near or far rail when shifting track. At Kennecott's Chino pit in New Mexico, a rectifier-transformer sub-station has been installed on a railroad car so that high voltage distribution can be easily moved ahead.

The Monoveyor is a one rail set-up for small pit haulage. Trackwork is simple and it is easy to move. A small diesel locomotive shuttles trains or single cars (1 yd capacity) back and forth automatically.

Belt conveyor haulage is widely used in the Iron Country and is increasing elsewhere. Their cheap operating costs permit considering tunnels and open-cuts in the pit wall to get feasible belt angles—about 30 deg maximum.

In Germany, curving conveyors are available which consist of a channel-track base structure, a continuous pulling chain, and individual carriers joined by a fold of flexible material. For long flights the British are concentrating on using separate wire ropes as the traction element on which rests a belt with a longitudinally grooved undersurface.

The skip hoisting approach is to run the track at very nearly the same angle as the footwall of the pit. The loading points are designed for easy moving to lower levels with the trucks dumping directly into a skip of the same capacity. Balanced hoisting of a pair of over-dump 22-ton skips are used at Pima and Marmora. Chino plans to use 40-ton skips. The Pima skip has a three-point spring suspension—a pivot on the lower axle—to accomodate some track irregularities (*E&MJ Mar 58*).

Underground muckhandling was partially covered in Part I (also see *E&MJ* Mid-Jun56 & 58).

For ore-passes the use of prefabricated sectional pipe is a growing practice. It can be erected fast, requires little maintenance and reduces hang-ups. For cut and fill stopes, Day Mines in Idaho makes welded tube sections 30 in. dia x 2 to 4 ft long from No. 14 gage mild steel. In Minnesota the Zenith mine uses ½-in. low manganese steel to make 3 ft dia x 18-in. bell-end pipe sections in 120 deg segments which are connected by a simple hinge-like fitting.

At the Tracy mine in Michigan, cribbed-raise linings are made from ¼-in. mild steel in 3½ ft dia x 3 ft long sections. The footwall 120-deg portion has an inner wear-plate of ⅜-in. Jalloy No. 3.

At Soudan in Minnesota, wear in 5x5-ft timber-cribbed raises is cut by hanging six lengths of old hoist rope along each side.

In many mines, concrete ore passes are used. And in these and in timber-cribbed raises, old rail is often used for greater wear resistance.

At Kiruna in Sweden, rubber-lined chutes are long-lived and quiet.

Chutes with double gates for premeasured loading are cutting spillage and speeding operations at both car and skip loading stations.

Cars with overlapping aprons at the ends also eliminate spillage.

Slushers have cut into the use of gravity ore-passes for gathering because of the reduced development work and their positive controlled action. They are also being used for scraper-trench loading of skips at many properties—especially where sticky ore or hang-ups are a problem, or where vertical development is difficult. The use of old rails in the bottom of scraper drifts and trenches seems to be dying—it is less troublesome to repour a full concrete floor.

In slushing, the recently-developed right angle turn set-up is attracting attention. It consists of a horizontal open sheave on an arm together with a special chain yoke for the bucket.

The rope-suspended belt conveyor has been mentioned in Part I as being increasingly applied to gathering well-broken muck. Another recent innovation in belt conveying is an idler arrangement for making a right angle turn. The German curving conveyors mentioned for surface work are also applicable to underground transport.

Reciprocating plate feeders on the chutes have minimized belt loading problems in the Iron Country.

Long main hauls with belts are cropping up in many districts. In iron, Cleveland-Cliffs' Mather mine installation will lift 700 tph up 800 ft vertically on a single belt flight, 3,791 ft long. In lead and zinc, Pend Orielle is extending its belt deeper; and in potash, PCA's 7¼-mile multi-section belt is notable.

Shuttle or gathering type trackless vehicles of several designs are now being used. Air-operated, wheeled and crawler dumpers which have integral over-cast shovels are a recent development. The self-loading, push-scraperlike Gismo now comes in a wheeled, rubber-tired model.

Conveyor-bottom shuttle cars are ideal for heights of 30-in. and up. Alternating current trailing cable models are now available as well as dc and diesel units.

Low-head dump trucks are proving to be useful in lead mines in Missouri and fluorspar mines in Illinois. Trucks and trailer-trucks up to 25-ton capacity are being used in thick industrial mineral deposits where drifts can be driven in ore. Bottom and side dumps as well as positive ejection types cut some of the headroom requirements.

Locomotives driven by compressed air carried in tanks are low-cost units for gathering and for short hauls at small mines. Diesel locomotives are useful for longer, semi-permanent lines—sizes start at ½-ton weights. But where ventilation is critical, the battery electric locomotive remains unchallenged for such work. On long permanent hauls, the large electric-trolley is difficult to beat.

Remote controlled locomotives—using a cable type control box or simply a trolley-wire switch—are permitting one-man loading and hauling at several properties.

A Swiss "electrogyro", 8½ ton, 100-hp locomotive is now being used for moderate-length hauls in tunnel driving and several mines in Europe. The British Coal Board has a 34-ton unit. One or two heavy flywheels are "revved-up" at the dump station by an inegral induction motor which then uses the kinetic energy to generate power for the traction motors while hauling.

On mine cars, a cushion of rubber rings was recently offered as a new axle suspension to cut loading shock and travel bounce damage.

Vibrators and pneumatic scraper-arms are being used for water-less, dustless removal of sticky muck from cars.

Welded, 90-lb track plus crushed rock ballast, big ditches, automatic block signals, power switches and trolley phones are proving their worth in raising haulage efficiency all over the world. Grinding rails to cut shock and wear is a maintenance effort that pays off too.

Skip hoisting was partially covered in underground development in Part I. Automatic loading and hoisting is on the rise. For monitoring such installations, closed circuit television is proving a handy aid. Semi-automatic push-button operation of friction hoists is a standard design.

Plastic friction inserts, rather than leather, for the friction wheels at Kiruna, last longer and raise the friction coefficient.

Muck pumping is being tested at several mines around the world as a simple low-capital-cost alternative to skip hoisting. Power consumption seems to be the principal objection. Nevertheless, it is already in use for elevating light minerals such as coal and gilsonite. In Red China, one such installation uses a 1.35-Sp.G. solution of calcium chloride to gain carrying ability. On near horizontal lines muck pumping is an established efficient means of transporting phosphate rock, coal, mill tailings etc. Some practices that have been recommended in this work are: a limited amount of slimes reduces friction and increases the fluid density and hence carrying ability; gentle curves cut scour, and vertical steps prevent rollback clogging; booster stations rather than single high-head stations are more efficient. (AMC Coal Show 1957; Mont-Sym 58).

WATER CONTROL in open pits and underground mines has been witnessing a steadily growing automation of pumping facilities. There also has been a wider application of submersible pumps, both deep-well and sump types. Glass impellers were reported useful to combat wear of suspended solids, in Britain.

Hydrological studies are becoming more common in planning (AIME Mtg58). New sealing materials are being used for some work, as mentioned in "Ground Control" above.

POWER AND MAINTENANCE has become one of the most critical aspects of mining. Rigidly systematic preventive maintenance by operators and roving mechanics have consistently proven to save costs. The complexity of machines is demanding formal training of mechanics rather than time-consuming on-the-job training. Best results also come from having specialized departments in the shop and roving teams of specialists.

For compressed air installations, both stationary and mobile, the screw compressor is an attention-getter this year. As with other rotary compressors it is compact and essentially vibrationless. But it has fewer moving parts, requires no lubrication oil to come in contact with the air and delivers a smooth steady flow of air. At least one is touted as having the advantage of very high single stage compression.

In electric power, improved methods of speed and power control are promoting the wider use of unrectified ac which is safer and more economical than dc (*MCJ* Jul & Aug 58). Where dc is demanded, underground distribution of high ac voltages is facilitated by the newer dry type transformers on skids and mobile vehicles.

Lubrication at operational sites can be done faster and with less danger of contamination by using disposable one-shot packaging of lubricants. Sealed, life-time-lubricated components are being introduced on more and more new equipment. Molybdenum disulphide is proving advantageous in dusty, wet, high pressure and wide temperature variation conditions. Other multi-purpose lubricants are cutting inventory requirements. They

also reduce the hazard of improper usage.

Protective canvas and plastic covers on equipment are promoting better care by operators as well as keeping out damaging dust and debris.

Flame priming of metal surfaces before painting results in a superior dry, clean surface and new torches have recently given the practice a boost.

FABRICATION AND CONSTRUCTION has a new tool in the explosive hardening of steel (*E&MJ* Jan59 NPD). Some suggested applications are: rail frogs, dipper teeth and crusher plates.

Aluminum applications continue to grow where its low weight and/or corrosion resistance can be used to advantage, e.g., muckhandling containers, concrete forms, rock bolts, etc.

Hardfacing by welding or metalizing is constantly being cited as a new practice at individual mines.

In building construction, precast concrete, lightweight concrete, laminated wood beams and asbestos-cement coated steel-panels are some newer materials that attract attention.

Plastics can be compounded into such versatile products that they are being used in many ways. Grouts and sealants in ground support are current test applications. Piping uses are growing, even for high pressures.

CONTROLS AND COMMUNICATIONS continue to be improved to gain the full potential of increased mechanization. Electronic "fault finders" which automatically pinpoint trouble in auto-controls are becoming standard items in new hoisting installations. Television is coming into its own as a means of monitoring hoisting, belt conveying, sumping, crushing and bin filling operations. Photoelectric "eyes" and radioactive devices are being used as tripping, synchronizing and other controls.

Underground, various self-contained-power telephones for semi-fixed installations and carrier-wire radios for moving installations are speeding up operations with increased safety. On surface, the mobile radio has been giving similar benefits.

SAFETY & HEALTH in uranium mining was the subject of USBM *IC 7834*, released this past year. It indicates that existing conditions demand improvement in dust control, ventilation, personal cleanliness and other aspects.

Ventilation of the deep gold mines in Africa and India requires considerable attention to cooling. Spot coolers appear to be the only way of getting around the problem of hot walls in the air passages although a simple lining with dead air space behind can help. Delivering dry air also has advantages and can be promoted by lining passages and covering ditches.

Resistance to air-flow in shafts can be cut 60% by streamlining shaft fittings, according to preliminary tests in South Africa.

The use of plastic-bonded glass fiber panels to form a lense-shaped ventilation passage along the side of a circular concrete-lined shaft in Canada was mentioned in Part I.

In the U.S., ventilation ducts of tubular polyethylene film stapled through vinyl tape to wooden hoops and hung on wire are inexpensive. At Minerva Oil's fluorspar mine in Illinois, 25-ft lengths of 4½ ft dia ducting is used to within 150 ft of the face without blast damage. A 4-ft dia, 5-hp propeller fan moves 12,000 cfm through 1200 ft (*MCJ* Aug58).

Other recent ventilation developments include: a 16½-ft dia, variable-pitch-blade, constant speed ac fan installed with its axis vertical at Inco in Canada; long, large diameter boreholes for ventilation; plastic sheeting and sprays to seal doors, bulkheads and brattice cloth; the compact duct-like Microdyne combination dust collector and recirculating fan; the use of radioactive tracers to detect leaks and to map flow; and the USBM's analog computer, designed to speed planning of new installations and predicting of the effect of changes.

For fire fighting, the USBM confirms the usefulness of the "foam plug" technique for smothering and cooling a mine fire. First developed in Britain, it works as follows: any common household detergent is mixed with water and sprayed on screening stretched across an entrance passage—the ventilation air will move the resulting foam plug several hundred feet.

In South Africa, 2-ft thick firewalls built of bagged vermiculite have proven successful in sealing off fires. The burlap bags, fireproofed with ammonium phosphate, hold 2 cu ft, yet weigh only 9 lb versus ⅓-cu ft sandbags weighing 35 lb.

For seals some distance away from the fire, large 3x2x12-ft rubberized fabric pillows filled with 2 psi air and laced together, are a British innovation (MJ Sep 19,58).

The CO_2 gas and dry ice technique used by North Range to kill a fire in a cribbed raise is worthy of repeating. The material was charged into the area after the raise was sealed. In charging the dry ice, ample protection from the resulting blast must be planned.

Noise control and improved lighting are being tackled by several organizations but they remain a major problem.

ENGINEERING SERVICES in the field of industrial engineering and scientific management were mentioned in Part I as being more widely used and holding great promise.

Surveying for surface mapping has been speeded by aerial photo techniques, and now electronic apparatus using radio and light waves are speeding distance measurements for precise ground control.

Drillhole orientation surveys are being speeded with miniature gyrocompasses and improved etched tube and photographic devices. Radioactive source and detector techniques offer a means of locating drillholes adjacent to underground openings.

Drafting continues to be shortcutted at more properties by using printed sheets, rubber stamps and stick-on labels. An electric area calculator that uses a pencil-like stylus was offered this past year.

Ore control in pits is being tackled with small, handy flag bases to outline blocks for shovels to work on. In uranium pits, movable towers which permit quick radiometric probing of loads as they leave are a clever means of directing trucks to the proper dump.

Geomechanics, or rock and soil mechanics, continues to grow in importance to mining technology as more engineers become aware of its scope. It is directly concerned with ground support and control and with rock breaking—including drilling, blasting and crushing. A related subject is the flow of muck in ore passes and stopes.

KEY TO REFERENCES: AIME-American Institute of Mining, Metallurgical & Petroleum Engineers; AMC Mtg-American Mining Congress Meeting 1958; CIMM Mtg. Canadian Institute of Mining and Metallurgy Meeting 1958; CMIA Mtg-Coal Mine Institute of America Meeting 1958; *CMJ-Canadian Mining Journal; CMM Bull-Canadian Mining and Metallurgy Bulletin* (CIMM); ColoSym-Symposium on Rock Mechanics, Colorado School of Mines 1956 or 1957; D&BSym UMinn-Drilling & Blasting Symposium, University of Minnesota 1956 or 1958; *GpP-Geophysical Prospecting; KGF Bull-Kolar Gold Field Mining & Metallurgical Society Bulletin; M&QE- Mine & Quarry Engineering* (London); *MCJ-Mining Congress Journal* (AMC); *ME-Mining Engineering* (AIME); *MgM-Mining Magazine* (London); Mid-AmerConf- Mid-America Minerals Conference 1958 (AIME, et al.); *MJ-Mining Journal* (London); MontSym-Symposium on Hydraulic Stope Fill, Montana School of Mines 1958; MSMSym-Symposium on Mining Research, Missouri School of Mines 1956, 1957 or 1958; *MsM- Mines Magazine* (Colo. Sch. Mines); NCB-National Coal Board, Great Britain; NPD- New Products Digest department of *E&MJ*; OpI- Operating Ideas department of *E&MJ*; SEcG- Society of Economic Geologists; *Skilling's-Skilling's Mining Review* (Duluth); Stoces' book-Stoces, B., & Hosemann, D.: *Underground Mining Methods* (in German), Ferdinand Enke Verlag, Stuttgart, Germany, 1958; USBM *IC, RI* or *Bull*-U.S. Bureau of Mines *Information Circular, Report of Investigation* or *Bulletin; WM& OR-Western Miner & Oil Review* (Canada); Wyo-MA Con- Wyoming Mining Association Conference.

FUSION will have no bearing on the near-by uranium picture.—P. Genachte.

LEAD-ZINC producers need a 28¢ combined price to thaw out.—C. Schwab.

FAVORABLE state tax instruments attract mining capital.—R. S. Palmer.

Western Miners Probe Future At CMA's 62nd Annual Convention

MINERS from West, East, Canada, Yugoslavia and elsewhere took a good look at mining today and tomorrow at Colorado Mining Association's National Western Mining Conference in Denver, Feb. 5, 6 and 7. The program listed 215 speakers and chairmen. Uranium and atomic energy discussions were the main attractions, but sessions on oil shale, readjustments in the lead-zinc industry, strategic minerals, gold and silver, national mineral policy, and mining and milling technology attracted good turnouts.

For Uranium—A Tough Post-1966 Interim Period

Dr. Paul F. Genachte, director of the Atomic Energy Division, Chase Manhattan Bank, New York, discussed the outlook for uranium so authoritatively at the 1958 Colorado Mining meeting, that he was requested to cover this subject again this year: He allayed the fears of uranium producers that fission would replace fusion in the near future with these comments: "The papers released at the meetings (of the Second Geneva Conference) last September certainly showed that remarkable progress has been made, but that we are still very far from a thermonuclear device which yields more energy than it consumes. The most conservative estimates indicate that it may take at least 10 years to achieve a controlled thermonuclear reaction in experimental devices, and it will take at least that long to develop industrial scale machinery that can compete economically with other sources of energy. The time scale given by some was as high as 50 years. In any event, if and when fusion is harnessed, it will undoubtedly not eliminate fusion, any more than atomic energy from fission will render coal, oil or natural gas obsolete. . . . *Fusion research for the foreseeable future will have absolutely no bearing on the uranium picture.*"

Genachte cautioned against any conclusion that nuclear power would replace conventional power on a large scale in the near future. He said "that although the capital costs per kilowatt will no doubt continue to decline in the years to come, a nuclear power station will probably never be as cheap as a conventional power plant. The confidence that competitive nuclear power is only a few years away is based on limited experience which shows, however, that nuclear fuel costs today are already lower than conventional fuel costs."

Surveying present plans for nuclear power installations, Genachte estimated that *"there will be approximately 20-million kw of nuclear capacity in 10 years* in the Free World out of a total installed capacity of some 500-million kw." To guarantee the inventory and fuel burnup for 20-million kw by earmarking the uranium consumption for 20 years for that capacity, Genachte said, would call for the setting up of 100,000 tons of uranium oxide. Assuming that the U.S. production of uranium oxide will be about 20,000 tons per year, and that of Canada and South Africa to be about 45 to 50,000 tons per year, Genachte concluded, "in the next ten years, even taking into account the other applications of atomic energy in addition to electricity, by even doubling the amount of 100,000 tons of uranium oxide and by earmarking uranium consumption [for the next 20 years for all nuclear power devices,] *there still would be a substantial surplus of uranium oxide to be stockpiled during that period.*"

His recommendation — "It makes sense that we should not increase the milling capacity now beyond what is planned. Furthermore, I do not think for one moment that it would be wise for our country or Canada to let present mills go out of business after the present contracts expire."

"A Report on the Domestic Uranium Industry"

Jesse C. Johnson, director of AEC's Division of Raw Materials, went far to clarify the future of the industry through 1966, but beyond that point Johnson said that there were experts

FOR URANIUM — a $300-million-a-year industry. Johnson and Jones of AEC.

MEMBERS OF THE LADIES COMMITTEE and guests relax at coffee-reception to study the crowded program of trips, luncheons, banquets and other social events.

far better qualified than he at the convention to appraise uranium's future.

Domestic output of about 12,500 tons of U_3O_8 during 1958 which was sold to the AEC for approximately $238-million, Johnson pointed out, exceeded the combined value of newly-mined domestic lead and zinc production totalling about $150-million in 1958.

"Concentrate production in 1959 will approximate 18,000 tons of U_3O_8," he said "having a value of *more than $300-million—which may be about the level of production through 1966.*"

Johnson outlined in considerable detail how private industry might enter into the production of atomic fuel by blending normal uranium with highly enriched material purchased from the AEC. "Under this blending procedure," he said, "a substantial part of the uranium used in making enriched fuel would move entirely through commercial channels, and never be handled by the AEC. The uranium industry could consider the economics of producing the various products used in the manufacture of nuclear fuel—uranium oxide, uranium monocarbide, metal, or some intermediate product, such as uranium tetrafluoride."

Two tiers of nuclear power experts, miners, uranium millers, and government representatives participated in lively panel discussions moderated by L. M. Jones, manager of Western Machinery Co., and G. T. Rummel of LaSalle Mining Co.

Ques. After the expiration of Circular 5 will the AEC have to regulate pricing to prevent millers from taking unfair advantage of miners?

Ans. We are making long-range contracts with producers. It is doubtful that a long-term contract could be negotiated at a price above that specified in Circ. 5.—R. F. Hollis, general manager, Uranium Reduction Co.

Summary. It is the general sense that there will be no serious difficulty in producers and millers getting along because of their dependence upon each other to stay in business.—L. M. Jones, moderator.

Ques. How can we best determine the future private market for uranium without AEC requirements and stockpiled material?

Ans. The future of uranium is tied to power. How fast will we use what we have? Assuming 85-million tons of uranium ore in the U.S., and consumption at the present rate of 5-million tons per year, we will have enough to last about 17 years. What is required to support a power program? In rough figures it takes ½ ton of ore per kw to start up a plant, and about 1/10 ton of ore per year to operate the plant. If we assume a 20-million kw capacity in the Free World by 1970, built up at the rate of 2-million kw per year, total requirements by 1970 to start up would be 10-million tons of ore. — H. C. Anderson, General Electric Co.

Ques. Can domestic uranium producers survive in a highly competitive Free World market after 1966?

Ans. If uranium can be produced abroad at a lower price after 1966, both the U.S. and private industry will buy it.—Dr. A. E. Flint, Radium King, Inc.

Comment was offered by one of the panel members that AEC should be urged not to take up its "alleged options" to purchase foreign concentrates after the 1962-63 period, and another query was made pertaining to foreign uranium purchases. This topic was referred to Jesse C. Johnson, director of AEC's Raw Materials Division.

Johnson explained that under terms of the AEC contract with Eldorado Mining & Renfiing Limited deliveries to AEC during 1959, 1960, and 1961 will be out 13,000 tons U_3O_8 per year. Most of the contracts will expire March 31, 1962. Some go to March 31, 1963. During this 1962-63 period, the bulk will be bought by U.K. AEC purchases will be about 2,000 tons. Referring to the "alleged options" previously mentioned, Johnson said that the U.S. has *actual* options on the bulk of Canadian concentrates through Dec. 31, 1966 at $8 per lb.

All overseas contracts, he disclosed, are through the Combined Development Agency in which the U.S. and the U.K. are participants. This buying agency covers concentrates produced in Africa, Australia, and Portugal. Purchases will total about 6,200 tons per year through 1962. There will be substantial reductions, Johnson said, in 1964 and 1965, and relatively small purchases in 1966. The U.S. share of the Combined Development Agency's purchases is about 5,000 tons per year. This amount will be reduced somewhat in 1960, with further reductions during the 1962-65 period.

Ques. Could producers join to build an up-grading plant, and thereby affect the tonnages which they are allowed to ship to mills?

Ans. The answer would be "No." Milling contracts are made in terms of pounds of U_3O_8.—G. Thornburg, Lakeview Mining Co.

Mining a la Jules Verne

"Let Russia have the Moon, we'd

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A MAJOR oil-shale industry is only a question of time.—Elmer F. Bennett.

better go after the sea," was one of the audience comments stimulated by a talk on deep-sea mining by John L. Mero, graduate research engineer, University of California. He estimated that 14.2-million sq mi of ocean floor contain economically mineable manganese deposits totaling some 200-billion tons of nodules averaging 20% manganese, and 0.50% each of nickel, copper and cobalt—*enough to supply the world for hundreds of years to come.*

Manganese dioxide, Mero said, is distributed in deep-sea sediments as grains, nodules, coatings on rocks, impregnations of porous materials and in other less important forms. Industry technologists have suggested many new methods to mine these nodules, including unmanned underwater bathyscaphes and large submarines with large-capacity mining chambers. Two most feasible mining units, according to Mero, are the suction dredge and the deep-sea drag-bucket dredge. He estimated mining costs for a drag-dredge to be about $5 per ton of recovered nodules at a depth of 1,000 ft, and $15 per ton at 5,000 ft. He also described a remote-controlled suction dredge which would deliver nodules through a 15-in. pipeline at a rate of 5,000 tons per day. Dredge cost would be about $2-million. Mining costs would be about $3 per ton at 5,000 ft, and 15c per ton extra for each additional 1,000 ft.

Research indicates that the ammonium carbamate process will be feasible to recover high-grade manganese dioxide or carbonate from the nodules. Since nickel, cobalt and copper amines apparently go into solution as complex metal amines, Mero suggested that the Sherritt Gordon hydrogen leaching process could be used to recover these metals.

Required capital investments estimated by Mero would be about $10-million for a 500-ton-per-day operation, and about $60-million for a 5,000-ton project. About 90% of the total would go into the processing plant.

One of the huge nodule deposits mentioned by the speaker was discovered on the Blake Plateau, about 200 miles east of the U.S., by the Dawnwind Expedition in 1958. Audience speculation—what would happen if a foreign power set up a sea platform in this area and started to mine manganese? Mero's suggestion — the United Nations had better get busy formulating undersea mining laws.

Why Certain States Attract Mining Capital

Observing that "U.S. business has put at least $28-billion into its operations overseas to turn out raw materials and goods," keynote speaker, Robert S. Palmer, executive vice president of the Colorado Mining Association, stressed the need for attracting mining capital to the U.S. "The policy of attracting business by tax instruments has, of course, been used domestically," he said. "For example, Florida has granted certain tax inducements to attract capital for construction of homes and other businesses in the state. Nevada does likewise by imposing no income tax nor any sales tax upon the mining industry. Canada excuses the mining industry from taxes in the production of metals until risk capital has been recovered. Experience teaches that the adoption of mineral policies and tax programs contrary to the best interests of the mining industry stifles production of new mineral wealth, destroys stable payrolls, does away with markets for local farm and ranch products, curtails the use of power and railroads, and cripples the hundred and one other industries which prosper when mining prospers."

Paradoxically, at the time when these words were being spoken, Colorado's state legislature was debating whether or not the Colorado mining industry was paying its fair share of state taxes. Considerable debate centered about a proposal by Dr. Morris E. Garnsey, professor of economics, Colorado University, that a 10% occupational tax on mining be levied to yield an estimated $8.5- to $11-million. Garnsey was reported in the *Rocky Mountain News* to have said that the mining industry was getting special treatment and paying less than its share of taxes in comparison to agriculture. In a noon luncheon talk "Observations," Royce A. Hardy, assistant secretary, Department of Interior, took note of the current Denver news stories on the local tax debate. Several Colorado mine operators left the convention to sit in on the tax discussions.

Wanted—Better Salesmen

Lead-zinc selling by the mining industry itself was stressed at a session chairmanned by Edward H. Snyder, president of Combined Metals Co., and W. R. Smith, resident manager of American Zinc Co. of Illinois.

The 18 mining states of the U.S. comprise 40% of the population, have 40% of the motor vehicles and 43% of the farm population, according to J. L. Kimberley, executive vice president, American Zinc Institute. Because of this, he suggested that miners cooperate in the sale of zinc in their own states by persuading highway departments to use more galvanized iron products, urging farm neighbors to learn of the advantages of galvanized sheet, and using more galvanized products in mine construction work. Contrary to indications in the press, zinc die castings are "more than holding their own" in the face of competition with other metals, he said.

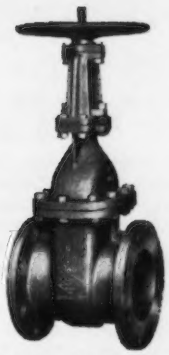
R. L. Ziegfeld, secretary-treasurer, Lead Industries Association, reinforced Kimberley's "sell-it-yourself" appeal to miners by suggesting that mining companies "be sure that lead gets full and fair consideration" when the companies purchase batteries, corrosion-resistant materials, etc. Among the new products being developed in the accelerated research program of the industry are enamels for aluminum, piezoelectric devices that will be used in supersonic wash machines and dish washers, lead superconductors and an exciting new semiconductor.

Lead-Zinc Thaw-Out

What the lead-zinc industry needs to "thaw out" is a minimum 28c combined price (say 13c for zinc and 15c for lead), Charles Schwab, chairman of the Emergency Lead-Zinc Committee, told the session. He said that although his committee's immediate work was trying to make quotas work, this effort did not preclude acknowledging that 1959 is going to be a most difficult transition period. With slowly improving industrial consumption of the two metals, he predicted that the true effect of the quota proclamation will not be shown until the fourth quarter of 1959, or perhaps until early 1960.

A second objective of the Emergency Committee has been to convince the Administration that the effect of quotas is weakened consider-

(*Continued on p 162*)



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This picture shows the many points of excellence in the design and construction of Jenkins Fig. 1327 Split Wedge Stainless Steel Gate Valves. Compare them with any valve you know. You'll conclude that it's hard to beat Jenkins at making valves, no matter what the material.

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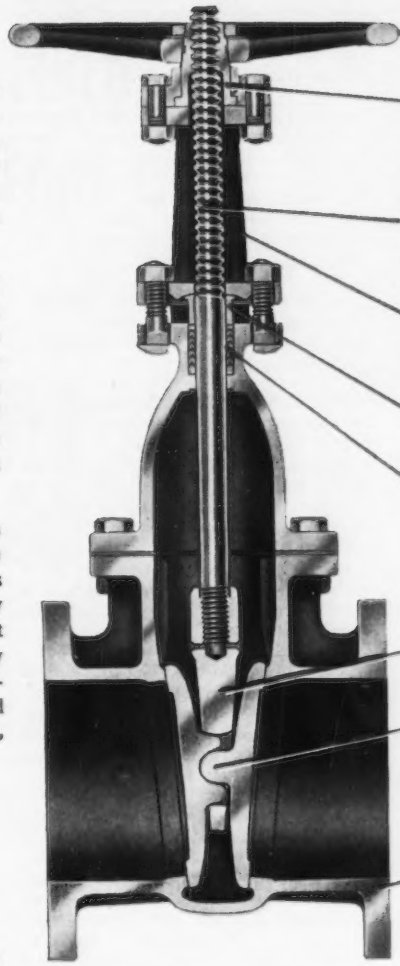

WHEEL of high strength malleable iron designed for firm grip and easy operation.

YOKE BUSHING, easily renewable. Made of bronze, for ideal thread engagement with stainless steel spindle, to prevent seizing or galling of spindle threads. Bushing of stainless steel is optional.

SPINDLE has long thread bearing surfaces with correct lead for easy, tight closing. Screws into wedge carrier, then secured by a stainless steel pin.

YOKE BONNET has liberal space between yoke arms for easy access to packing box. Precision machined flange face assures uniform contact with gasket for a tight body-bonnet joint.

GLAND consists of two pieces — gland flange and gland follower — eliminates binding of follower in case gland bolts are tightened unevenly.

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SPLIT WEDGE is the ball-and-socket design which automatically adjusts to the tapered seating surfaces for positive shutoff. The discs, revolving freely in the wedge carrier, produce a self-cleaning action on seating surfaces and reduce possibility of galling and seizing.

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WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Mining

Method for detonating unprimed base charges of high explosives, wherein a slurry of the explosive material has been pumped into the stratum. Material is detonated by shock waves from a detonated string of shaped "Munroe jet" charges, placed in a nearby hole. J. R. Hradel. No. 2,867,172.

Metal and Mineral Processing

Combination electrostatic-magnetic apparatus for separately collecting magnetic and non-magnetic materials is especially useful in the beneficiation of magnetic taconite and magnetite iron ores. L. M. Roberts, assigned to Research-Cottrell, Inc. No. 2,866,546.

Improved method for wetting and mixing iron ore fines and the like in preparation for sintering. Ingredients are moistened and comminuted separately and then mixed together with addition of water or other liquid. Dolomite, bauxite residue, or lime may be added to one or more of the ingredients. B. Weilandt and W. Storsberg, assigned to Kloeckner-Huttenwerk Haspe A.G. No. 2,866,699.

In a process for treating the so-called Chattanooga shale formation of Tennessee and adjoining States to recover the uranium, aluminum and iron content thereof, the ore is chlorinated and the resultant volatile chlorides contacted with granular alumina, which takes up the uranium. Remaining chlorides are separated and contacted with Fe_2O_3 to convert $AlCl_3$ to Al_2O_3, which is then recovered. The remaining $FeCl_3$ is oxidized in heated air to form Fe_2O_3. Economy is obtained by recycling chlorine gas, Al_2O_3, and Fe_2O_3. W. R. Hanley, assigned to U.S. Atomic Energy Commission. No. 2,867,501.

In the separation and recovery of nickel and cobalt values, ore is acid leached and the values concentrated, such as by treatment with lime or limestone by precipitation as an acid-soluble alkaline mixture of hydroxides or carbonates. Precipitate is re-leached under pressure with water in the presence of CO_2, which precipitates unwanted metals. Solution is drawn off and treated by known methods to separate the nickel and cobalt values. T. K. Roy, assigned to Chemical Construction Corp. No. 2,867,503.

Fluidized-bed roasting of pyrites or other low-grade sulphides to recover a relatively high yield of high-purity SO_2, and leave a virtually sulphur-free residue suitable for further treatment to recover its metal content. E. J. Roberts, assigned to Dorr-Oliver, Inc. No. 2,867,506.

Mr. North is patent consultant, Washington, D. C.

Agglomeration of low-grade, finely-divided aluminum ores preliminary to smelting, transporting, or storing them. Ore is mixed with lime and a limited quantity of water, and the mixture extruded and dried. Coke may be added to the mixture as a reducing agent, and silica to facilitate binding of the smelting mixture. H. Loevenstein, assigned to Harvey Machine Co., Inc. No. 2,867,525.

Improved process for the fluidized roasting of arsenopyrite and iron sulphide ores which contain arsenic impurities to yield an arsenic-free roasted product. Ore is first partially roasted to volatilize the arsenic, and the arsenic in the roaster gases then oxidized and separated. Partially roasted bed of iron sulphide is readily oxidizable. T. D. Heath and N. G. T. Nolle, assigned to Dorr-Oliver, Inc. No. 2,867,526.

Improved gas-reduction method for producing high-purity copper powder from a solution containing copper and at least one of the metals nickel and cobalt. Reaction is conducted in a series of reducing steps. D. J. I. Evans and S. Romanchuk, assigned to Sherritt Gordon Mines Ltd. No. 2,867,528.

COPIES of U.S. patents can be purchased at 25¢ each from Commissioner of Patents, Washington 25, D. C.

Extraction of gold from refractory ores or concentrates by cyanidation is improved by subjecting the ore to preliminary roasting in a low-oxygen atmosphere followed by oxidation in an aqueous acid solution. Arsenic and antimony are distilled off in the roast gas, and at least a part of the sulphur is eliminated in the oxidation step. F. A. Forward and W. C. Lin, assigned to Sherritt Gordon Mines Ltd. No. 2,867,529.

Process for fluid-bed chlorination of rutile, ilmenite or other titaniferous materials, whereby overheating is effectively prevented. A. N. C. Bennett and J. D. Groves, assigned to British Titan Products Co., Ltd. No. 2,868,622.

In the treatment of pyrite or other iron sulphide ores, the ore is mixed with an iron-oxide slag or the like without fluxes, and heated in a closed electrode furnace. Matte is crushed and leached with dilute H_2SO_4 to dissolve the iron. S. A. Aannerud and E. Mostad, assigned to Pyror Ltd. No. 2,868,635.

Design for a conveyor belt idler to which particles of granular solids, particularly wet or cold iron ore, will not adhere. J. P. Vidmar, assigned to M. A. Hanna Co. No. 2,869,716.

In the treatment of chromite, ilmenite, and similar ores, the ore is nodulized, and the nodules coated in a rotary kiln with sodium silicate and fine coal or coke. F. O. Wienert, assigned to Union Carbide Corp. No. 2,869,850.

Slurry solvent leaching process for recovering uranium from high-lime carnotite ore. Mineral acid solubilizing agents are used under non-aqueous conditions. R. R. Grinstead, assigned to U.S. Atomic Energy Commission. Nos. 2,869,979-80.

Process of roasting pyrite or pyrrhotite ore to produce SO_2 and a roasted product suitable for treatment for metal values. Material is roasted in air without sintering or melting. T. Rosenqvist. No. 2,869,999.

Fluidized-bed process for recovering elementary sulphur from Peruvian and Chilean hard sulphur ores and the like. An unusually coarse feed may be used. G. P. Giusti and A. R. Johnson, assigned to Texas Gulf Sulphur Co. Nos. 2,870,001-2.

In the conversion of hematite to magnetite for subsequent magnetic separation from gangue, the ore is crushed to minus 150-mesh and fed quickly through a reducing flame under strong reducing conditions, to convert a considerable part, although not all, of the hematite present to magnetite. P. E. Cavanagh, assigned to Ontario Research Foundation. No. 2,870,003.

Device for continuously splitting an ore pulp from a taconite grinding mill into two diverging streams, so as to facilitate further milling in parallel. I. H. Wynne, assigned to Reserve Mining Co. No. 2,870,909.

Method of separating columbium values from tantalum values in columbite-tantalite ore, fergusonite, blomstrandine residue, and the like. Values are obtained by selective solvent extraction from an amine-treated aqueous solution containing hydrogen fluoride. H. A. Wilhelm and R. A. Foos, assigned to U.S. Atomic Energy Commission. No. 2,871,092.

A self-fluxing synthetic iron scrap is made by mixing lime with iron ore fines, and partially reducing the iron in a fluidized bed at a temperature too low to alter the gangue. Material is then agglomerated without reoxidation, and the agglomerates coated with additional lime. J. C. Agarwal, assigned to U.S. Steel Corp. No. 2,871,115.

Recovery of metals which form sulphates that are soluble in water or dilute acid solutions from ores and concentrates containing sufficient sulphur to form such sulphates. $Fe(OH)_2$ or like hydroxide is added to the digestion pulp. Ores that may be advantageously treated by this process include chalcopyrite, bornite, arsenopyrite, chalcocite, greenockite, sphalerite, cobaltite, and pentlandite. L. F. Clark. No. 2,871,116.

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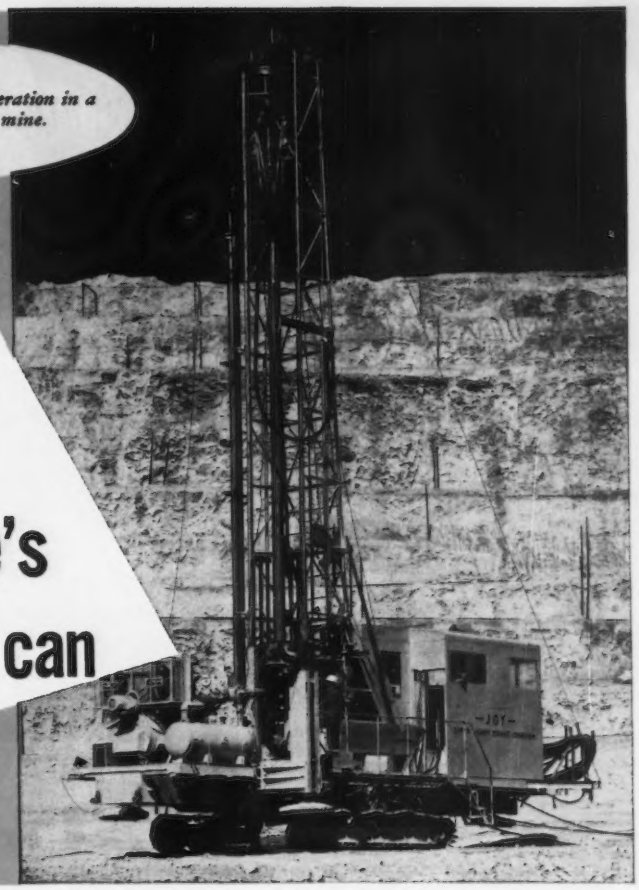

Joy 60-BH Drill in operation in a large Southwest copper mine.

the JOY 60-BH Super Heavyweight Champion

Here's the champion at drilling larger, lower-cost blastholes where the going is tough and high production is a *must.* The Joy 60-BH Super Heavyweight Champion has the power, the stamina . . . the sheer muscle . . . to bottom blastholes fast, shift after shift, month after month, in hard or soft formations. And it can drill out of the hole, too, when necessary. Here's why the performance of this big drill cannot be matched—it excels *in all three* of the features which determine bit penetration:

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MORE EFFICIENT CUTTINGS REMOVAL—Only Joy uses a heavy-duty, industrial-type, water-cooled air compressor to insure an optimum, continuous air supply.

Other features . . . rod handling device to reduce heavy rod handling and the longest derrick available to reduce or eliminate rod additions.

Only Joy has a complete line of rotary air-blast drills:

56-BH	6¼" maximum hole diameter
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59-BH	9" maximum hole diameter
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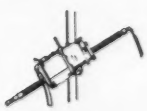
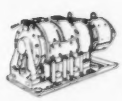


Core Drills



Slushers

Rock Bits

Drillmobiles

OPERATING IDEAS

How to Increase Tractor Shovel Operating Efficiency

TRACTOR SHOVEL OPERATORS can add more safety and production to their schedule by putting the following operating hints to use. The ideas come from Verne Wabush, who runs a 4 cubic yd Michigan shovel tractor (Clark Equipment Co.) at Meshberger Stone Co., Columbus, Ind.

Develop a smooth work cycle. Avoid tire screeching, jerky movements, and engine racing which actually waste time and put extra wear on the machine.

Remain active between loadings. Work the stockpile, clean up corners, loosen the bank, and level the grade. Then, when trucks come for loading, no time will be wasted.

Don't overload the rear axle of the truck. According to Fawbush, some tractor shovel operators place the load toward the rear end because they don't want to spill material on the truck cab. He said that Meshberger solved the problem by building a bucket spill guard on the side nearer the truck cab (see photo). Haul units are always loaded from the left side to make it easier for the driver to back up and position his truck. The spill guard does not interfere with stockpile work and permits the bucketload to be dumped within inches of the truck cab.

Do not bounce material into the truck bed. Ease the first few loads over the sideboards or tailgate. The material, especially if it is rock, will shake and jar the truck.

Do not try to lift too much at a time. Crowd the bucket partway into the material and then slowly raise the bucket as the tractor backs away. Do not bury the bucket and then try to lift it out. By "slicing" off a bucketful at each pass, heaped loads will be gotten quicker and the machine will be put under less strain.

Do not lift the load high and then roll to the haul truck. Instead, for stability, keep it low and then, as the tractor nears the hauler, raise it to the necessary height.

Watch the load at all times. Stop the machine if you have to look in either direction. When loading into the truck, make sure that the driver is not hanging out of the cab.

Pressured Gel Cuts Mine Seepage

A CHEMICAL first used to reduce water intrusion in oil drilling projects is expected to be useful for controlling water seepage in general mining operations, according to the Halliburton Oil Well Cementing Co., Duncan, Oklahoma.

Called Hydro-Lok "PWG," Halliburton's chemical is a polymeric water gel that penetrates the capillaries of a water bearing formation. Its initial viscosity is almost as low as that of water, which aids its entry into the formation.

A 250,000 barrel butane storage cavern, cut into granite, was producing a small amount of water from two fault zones and seepage from many fissures. "The gel and a special resin cement," Halliburton reports, "were used for the treatments—the cement was employed as a bulking agent when spaces were large enough to require filling prior to sealing. The two materials were mixed in batches within the cavern, 306 ft below the surface. Holes six to 32 ft deep were drilled to intersect the water-bearing fissures, packers were then set in the holes and the water control agents were squeezed in and held under pressure (see photo). Injection pressures ranged from 400 to 1200 psi. Setting time of the gel was adjusted to vary from eight minutes to one hour.

"After 33 working days, more than 95% of the water seepage had been stopped. This reduced the intrusion to a measured rate of less than ½ gpm.

"Some 600 treatments were made, varying from three to 800 gallons each. A total of 7,946 gallons of gel and 736 gallons of resin cement were consumed."

Vibrator Helps Clean Mine Cars

DIRT-LADEN mine cars can be cleaned by vibration, according to *UGOLJ*, a Soviet publication.

The Russians said that cars could pick up enough clinging debris to eventually cut the actual pay load by as much as 25%. They also said that present cleaning methods have serious drawbacks. Hydraulic processes create water disposal problems and will not work at low temperatures. Compressed air methods cause dust problems. Shock-cleaning may remove dirt but it may damage the mine car.

After it has been emptied, the mine car is pushed onto a drum-shaped track section. The car is secured and then flipped upside-down while two off-center disks, driven by an electric motor, shake it for about 15 seconds.

OPERATING IDEAS *(Continued)*

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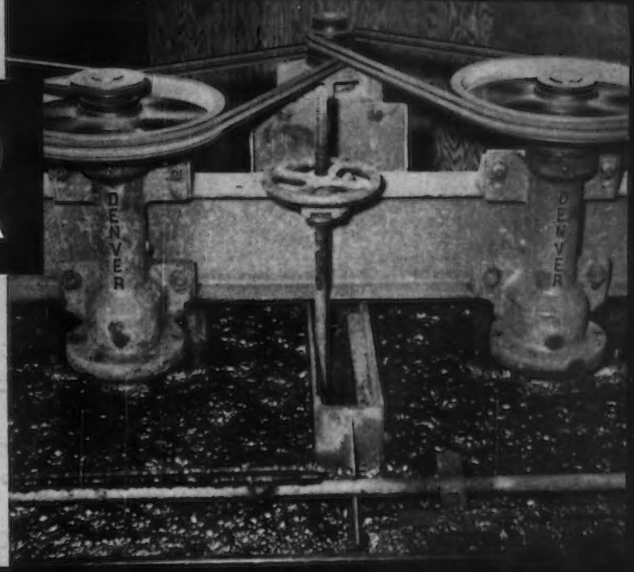

MOLYBDENUM Recovery from Copper

WHY...Denver "Sub-A" Flotation can do this job so well

Molybdenum values in copper are lost unless recovered prior to smelting. After the copper-moly concentrate is made in DENVER Free-Flow type flotation machines, it passes to DENVER "Sub-A" Cell-to-Cell Machines which have the *selectivity* and *flexibility* to upgrade the molybdenum to the required high grade market product.

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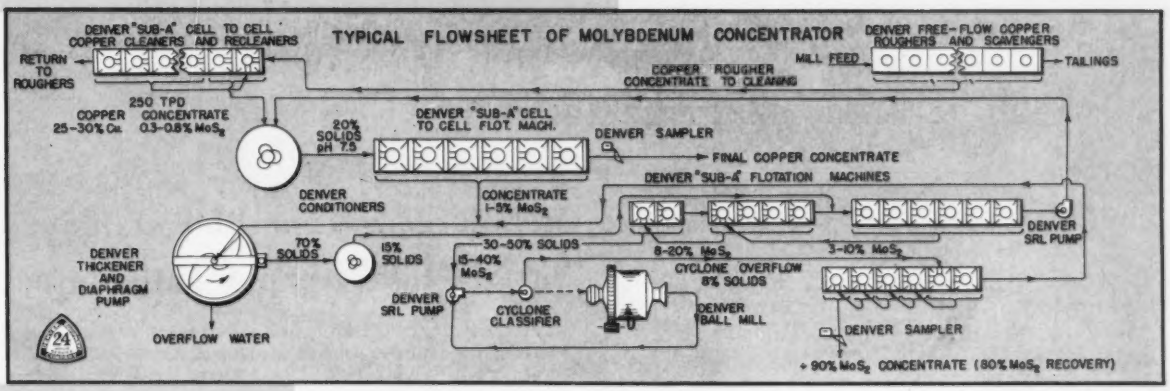
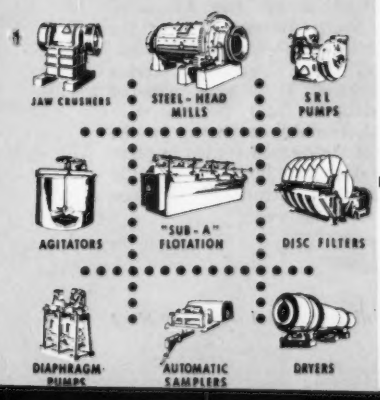
DENVER Ore Testing Service eliminates costly trial and error methods of perfecting flowsheet for final mill circuits. It takes the guesswork out of a big investment by making sure *in advance* that the ore can be milled at a profit. DENVER Ore Tests provide complete batch and continuous test data, flowsheet, as well as description and size of equipment to mill desired tonnage at highest profits. DENVER Ore Test Reports are used by mining companies, banks, governments and investors. Run DENVER Ore Tests to check results obtained in your own laboratory. Write for sample-shipping tags and ore test data sheet.





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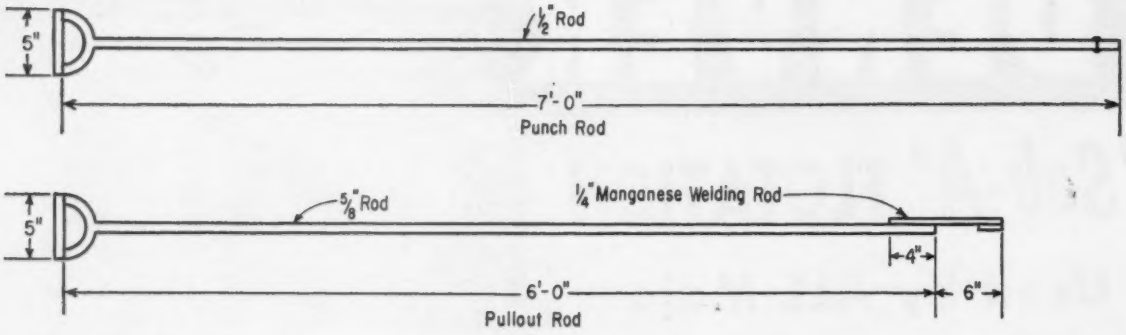
OPERATING IDEAS *(Continued)*



Benguet Now Recovers Rock Bolt Shells

ROCK BOLT SHELLS can be satisfactorily recovered by using a set of two easy-to-make rods, according to A. P. Ploesser, chief mines engineer, Benguet Consolidated, Philippines. One rod (7 ft) pushes the plug out of the shell while the other (6 ft) extracts the shell.

Ploesser said that "in our tunnel we recovered 4,710 bolts and washers and 2,446 shells. Some of the plugs were also recovered but usually it was difficult.

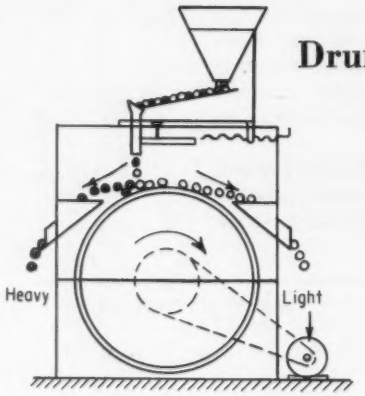
"Generally, we only worked on shells in relatively safe areas away from the vein intersections and, in doubtful places, the entire bolt assemblies were left in place. After the ½-in. rod punches out the plug, the ⅝-in. rod passes into the shell. The sharp-edged "hook" on the end of this rod can be caught in one of the small corners formed by the shell's four leaves.

"Though the shells were rusted, almost all of them were in good condition. One man could retrieve 30 or 40 shells per shift—we used no stulls or jacks to temporarily hold the back. We retreated toward the portal and never re-entered the stripped areas."

Since a relatively small number of plugs were recovered, Benguet figured them in as a total replacement and broke down their savings as follows:

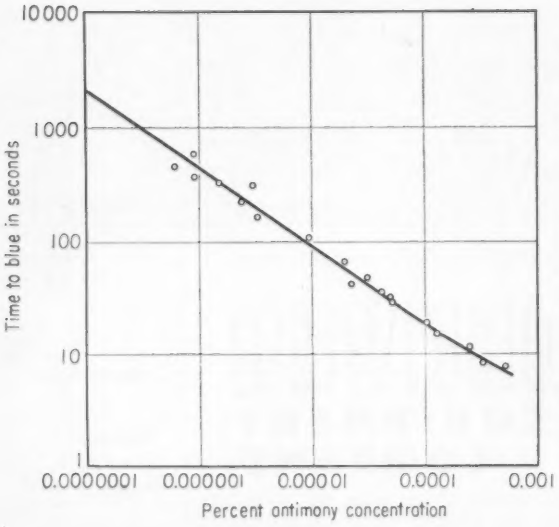
Bethlehem shell	0.45*
Bethlehem plug	0.22
Initial cost of shell recovery	0.67
Contract labor cost, retrieving	0.25
New plug	0.22
Cost of reconditioned, retrieved shell assembly	0.47
Saving per shell assembly	0.20

* Official rate—2.00 = $1.00.



Drum Classifies By Density

A SIMPLE REVOLVING DRUM has been designed and put to use in the Chomjakovsk limestone pit, USSR. The designer, N. Timoshenko, claims that the unit will classify by size and density. Unit is simply a metal drum which is fed near the top. Light particles are carried in the direction of the drum's travel, while the heavies bounce away from the direction of rotation. By varying the speed of the drum and the point on the upper arc of the drum where the feed strikes, the cutpoint in size or density can be varied almost at will.



Metallurgists Time Blue Oxide Surface Film to Spot Antimony

METALLURGISTS at Port Pirie have developed a simple graph which relates antimony content in drossing kettle lead to the time required to produce the blue color of the surface oxide film.

J. E. A. Gooden, research officer, Broken Hill Associated Smelters Pty. Ltd., Port Pirie, South Australia, related the development in the Institute of Mining and Metallurgy *Transactions*, vol. 68, Part 4, January 1959. Samples of varying concentration from 0.001 to 0.0000001% Sb were prepared (using radio-active antimony and pure lead). Samples were melted and the time to blue determined as shown on the graph. Mr. Gooden suggests that if the method is used in plant practice, the sample should be taken directly from the kettle to the test crucible to eliminate remelting errors and to reduce the time between the mill and final analysis.

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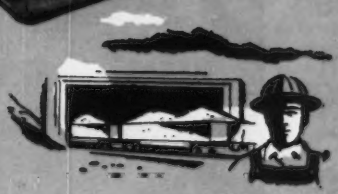

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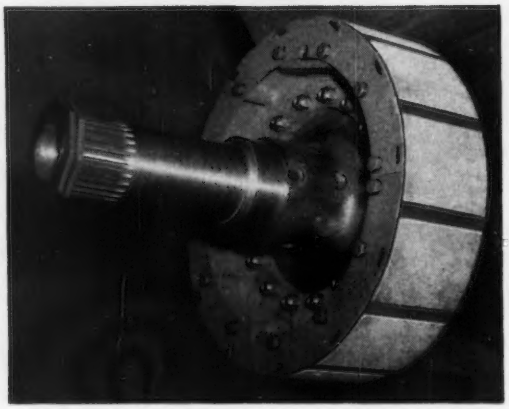

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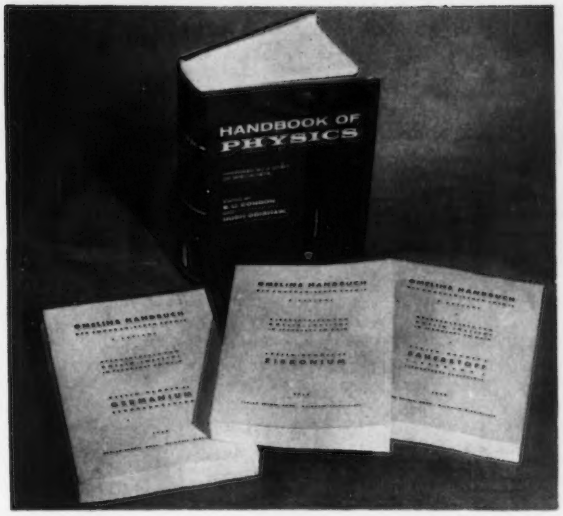
NEW BOOKS



McGraw-Hill and Gmelin Handbooks

Handbook of Physics, edited by E. U. Condon and Hugh Odishaw. Prepared by a staff of experts, this fantastic volume concentrates on principles, ideas, concepts and mathematics in all branches of classical and modern physics. Emphasis is on the mathematics—the book is not intended for beginners or those that do not have mathematics through advanced calculus. Part I reviews mathematics in 13 chapters. Part II discusses mechanics of particles, while Part III treats mechanics of deformed bodies. Electricity, magnetism, heat, thermodynamics, state, transfer, optics, atomic physics, the solid state, and nuclear physics are all reviewed. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1504 pp. Price $25.

Germanium, Supplement, System No. 45, 8th ed. features bilingual English and German table of contents. Supplement to the 1931 volume on Germanium covers all published research between 1931 and 1953. Technical preparation of compounds is described in detail. Published by Verlag Chemie, Gmbh, Weinheim/Bergstr., West Germany. May be obtained in the U.S. through Walter J. Johnson, Inc., 111 5th Ave., N. Y. 3, N. Y., or Stechert-Hafner, Inc., 31 East 10th St., N. Y. 3, N. Y. 576 pp. 290 graphs. Price $79.68 (paper bound) and $80.88 (cloth).

Zirkonium, System No. 42 and Hafnium, Supplement, System No. 43 complete the treatment of Subgroup 4B (Ti, Zr, Hf and Th) in the 8th ed of the Gmelin Handbook Series in Inorganic Chemistry. Published by Verlag Chemie and available in the U.S. at addresses listed above under *Germanium*. *Zirconium* contains 448 pp, 57 charts. Price is $62.64 (paper) or $63.84 (cloth). *Hafnium* supplement is 23 pp, 1 graph at price of $4.08 (paper) or $5.28 (cloth).

Sauerstoff, Section 3, System 3, 8th ed. is devoted to elemental oxygen and begins with preparation in the laboratory. Total of 275 pages are devoted to physical properties. Published by Verlag Chemie and available in the U.S. at addresses listed above under *Germanium*. 518 pp. 100 graphs. Price is $67.92.

How to Supervise People, by Alfred M. Cooper. Fourth edition of this simple, easy-to-read manual on better supervision of employees. Covers hiring, discipline, accident prevention, promotion, teamwork, training, and a host of other facets on personnel supervision. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. 244pp. Price $4.95.

Minerals Yearbook, Vol. I, Metals and Minerals (except fuels), 1956. Prepared by the U.S. Bureau of Mines. May be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $4.50 (cloth).

Kinetic Theory of Gases, by R. D. Present. New addition to the International Series in Pure and Applied Physics. A short book emphasizing the essentials and currently important parts of the subject. Published by McGraw-Hill Book Company, Inc. (address above). Illustrated in 267pp. Price $7.75.

Dowex Ion Exchange, prepared by Dow Chemical Co., Midland, Michigan. Intended for the process engineer and laboratory scientist seeking a ready reference to ion exchange technology. Ion exclusion and ion retardation are included. Copies may be obtained for your company's library through Engineering Chemical Sales, Dow Chemical Co. Illustrated in 75pp.

Introduction to the Theory of Sound Transmission, with application to the ocean, by C. B. Officer. This is the first book to be published on the theory of sound since 1894 and is part of McGraw-Hill Series in the Geological Sciences. Published by McGraw-Hill Book Company, Inc. (address above). Illustrated in 279pp. Price $10.

BOOKS presented on this page may be obtained by writing directly to the publisher mentioned in each individual item. E&MJ does not offer for sale any of this literature unless stated.

Bureau of Mines

• Applications for the following free literature should be made to the address listed below. Because of the limited editions, only one copy of any particular edition can be sent to any one person, and only a modest number of a variety of publications can be furnished to an applicant. Please order only those publications actually needed. Publications Distribution Office, U.S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.

Report of Investigation 5400. Investigation of the Cuyuna Iron-Range Manganese Deposits, Crow Wing County, Minn. Progress Report 1, by W. E. Lewis, L. F. Heising, J. W. Pennington and Charles Prasky. Beneficiation and roasting results are reported. Illustrated in 49pp.

Report of Investigation 5411. Manganese Resources of the Batesville District, Ark. Part 2 of 3, by H. D. Kline and W. F. Brown. Resources and drilling records. 46pp.

Information Circular 7789. State Regulations Pertaining to the Use of Internal Combustion Engines Underground, by J. C. Holtz and E. J. Gleim. 24pp.

Information Circular 7830. Bibliography of Zirconium. Supplement to Information Circular 7771, by Eleanor Abshire. 216pp.

Information Circular 7836. Sulphur Dioxide—its chemistry and removal from industrial waste gases, by D. Bienstick, L. W. Brunn, E. M. Murphy and H. E. Benson. 96pp.

Information Circular 7843. Manganese Deposits of Western Arizona, by L. L. Farnham and L. A. Stewart. 87pp.

Information Circular 7844. Southern Alaska's Mineral Industry, by Alvin Kaufman. 37pp.

Information Circular 7845. Recommended Safety Standards for Surface Auger Mining. 11pp.

Information Circular 7847. Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants, July 1954 to December 1956, by Sidney Katell. 100 pp.

Information Circular 7854, Exploration, Development and Costs of the Stormy Day Tungsten Mine, Pershing County, Nev., by A. C. Johnson. 9pp.

Information Circular 7855. The Mineral Industry of Turkey, by L. Nahai. 140pp.

Huge Uranium Ore Find Is Reported

UTAH CONSTRUCTION CO. is reported to have developed between three and four million tons of high grade uranium ore in the Wind River formation of the Shirley Basin area of Wyoming.

But, ironically, most of the ore reserve probably will not be placed in the new uranium concentrates purchase program of the Atomic Energy Commission.

"The Shirley Basin could conceivably become the largest deposit of uranium in the United States—bigger than all the uranium found in the Grants area," said a mining man close to the exploration in the basin.

First hint of the huge orebodies, grade on which is said to average one per cent U_3O_8 or better, came in annual report to shareholders of Utah Construction.

"Exploration activities in the Shirley Basin in Wyoming (near Casper, Wyo.) have progressed favorably and the findings of our geologists indicates that Utah (Construction) controls a high grade uranium zone on that area," said the report. The stockholder statement significantly labels the big discovery as a "potential for the future."

On basis of reserve allocations for the Lucky Mc Uranium Co. mill in Wyoming's Gas Hills district, U-C was given a production of only 83 tpd through Dec. 31, 1966 by the Atomic Energy Commission. This allocation was based on reserves as of Nov. 1, 1957. However, it does not appear that AEC at this time is prepared to accommodate any further expansion of milling in Wyoming—above that recently established for the Gas Hills-Crooks Gap area. Thus a government market for the new ore bonanza, as indicated by the U-C stockholder report, is a future one related to sale of uranium to commercial sources.

A spokesman for the Atomic Energy Commission's Grand Junction Operations Office confirmed that both Tidewater Oil Corp. and Kerr McGee Nuclear hold extensive claims in the basin.

Both the firms have substantial ore reserves and AEC is presently negotiating for inclusion of some of these ore reserves in milling contracts and concentrates purchasing running from March 31, 1962 to Dec. 31, 1966, it was reported.

Utah Construction Co.'s wholly-owned subsidiary, Utah Mining Corp., was the only firm with any blocked out ore on Nov. 1, 1957 which could be accommodated in the recently announced Wyoming mill expansion program, AEC said.

Subsequent to Nov. 1, 1957 and Nov. 24, 1958, both Tidewater and Kerr McGee have blocked out ore. Their ore could be accommodated in mill contracts for 1962-1966 period.

While AEC confirmed that the ore was "much higher grade" than that found at Gas Hills district in the Wind River formation, a spokesman said that he was not "certain it is as high as one per cent."

The Shirley Basin discovery is "a big one, all right" said the AEC spokesman. He said he thought the three to four million ton estimate was "generous", however.

"It may be that there is a sizeable tonnage of ore in the Basin which would have to be milled and sold after 1966," *E&MJ* was informed.

The Tidewater and Kerr McGee orebodies lie in several "layers", as is typical in Wind River in the Gas Hills.

Depth is between 100 and 200 feet.

Utah Mining Corp. is reported preparing to sink a development shaft and to carry out additional evaluation of its ore discovery. A shaft will be necessary, also, to produce the maximum allowable of 83 tpd for the Lucky Mc mill.

It is believed that the reason Utah Construction is not proceeding at this time to open pit development is the fact that extensive overburden removal, equipment costs, etc. would be involved in such a venture. An ore rate of 83 tpd would not accommodate such a development, of course.

Lucky Mc Uranium, 60% controlled by U-C, does not have a claims position in the basin.

B.C. and Yukon Chamber Cites Mining Curbs

RESTRICTIVE LEGISLATION and mounting inflation were described as disturbing threats to mining at the annual meeting of B.C. and Yukon Chamber of Mines, in Vancouver Jan. 13.

The Chamber elected consulting geologist Dr. Christopher Riley as president, to succeed James A. Pike.

V. C. Wansborough of Toronto, vice-president and managing director of Canadian Metal Mining Association urged that the industry fight against restrictive action and legislation, whether imposed from outside the country (as in U.S. import restrictions) or whether imposed by Canadian legislatures.

"It is of supreme importance to us in Canada at this particular period of our national development that we, of deliberate and set policy, not only keep alive but give impulse and encouragement to those incentives which drive ahead a pioneering and expansive economy," he said.

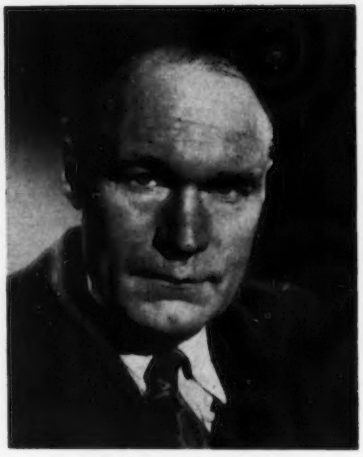
The serious effect of inflation on the economy of the mining industry was stressed by Mr. Pike in his report.

"Our metals are sold on world markets, and though these have been depressed, costs of labor, supplies and services have continued to rise", he said.

"Basic industries have brought prosperity to this province and our wage scale and standard of living is the highest in Canada.

"However, competition in world markets is so intense that if we hope to retain those markets, our production costs must be reasonable. We do not want to price ourselves out of business. It would be well for all of us, government, management and labor, to hold the line against inflation."

Thomas Elliott, manager of the Chamber, expressed hope that iron ore legislation would be amended at the coming session of the legislature.

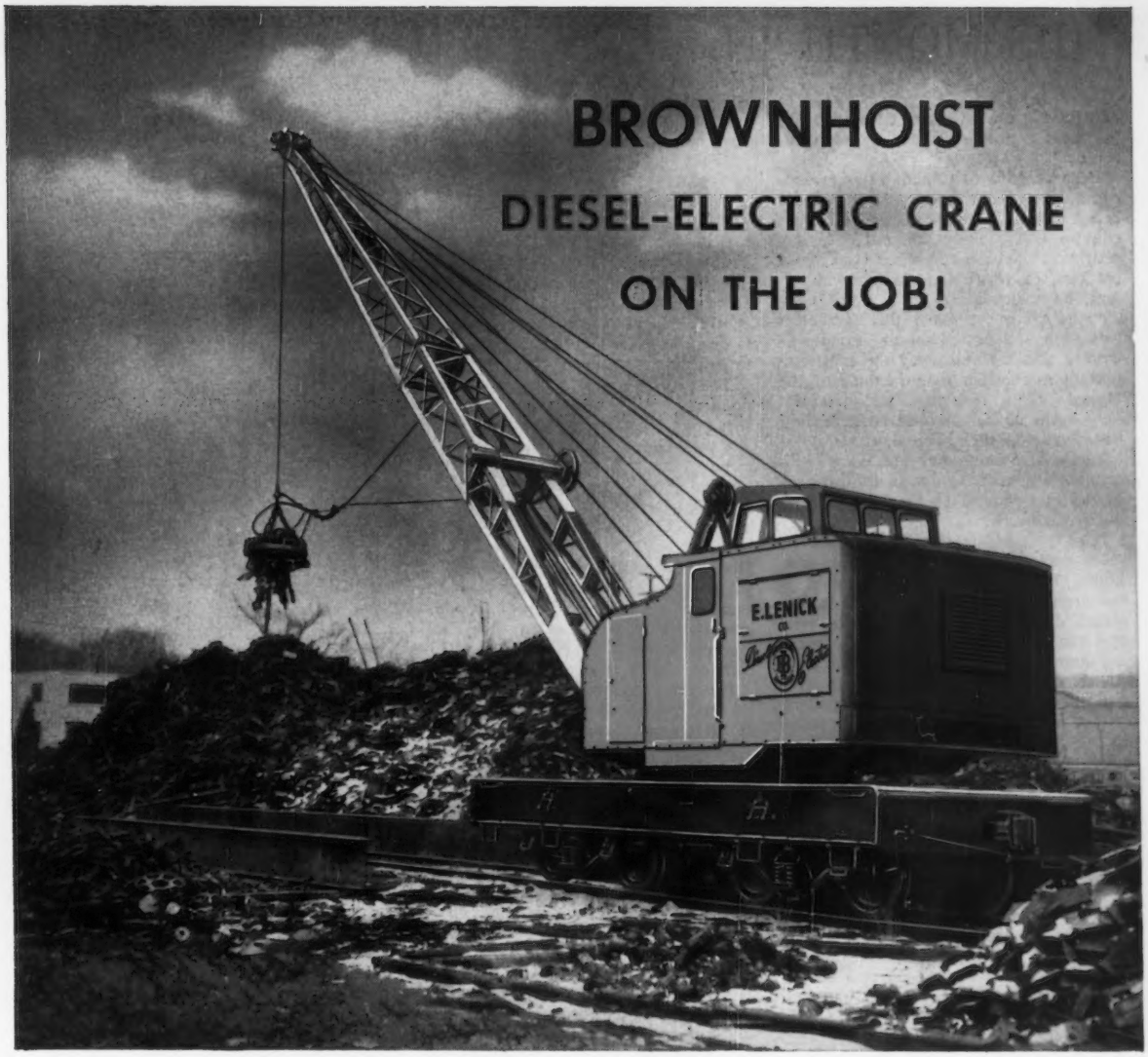


Dr. Christopher Riley

The Mineral Property Taxation Act, he said, had brought stagnation to iron ore prospecting.

"Iron ore must sell on foreign markets. If all restrictions are removed, I am confident our prospectors and operators will discover and develop iron ore deposits that will assure us of ore reserves many times greater than have been known in the past. These reserves would, when economically feasible, provide the basis for bringing about establishment of a local steel industry," he said.

Mr. Wansborough, discussing the future of mining, said Canada "must shake off the pattern of thinking on social, economic and political matter which is derived from other countries. We in Canada are at an entirely different stage in our economic evolution than the United States is, or any other country,



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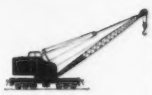
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and therefore what may be sound policy for them is not necessarily sound policy for us."

Because 25% of Canada's national income comes from exports, the great bulk being primary industry products, this country is especially vulnerable to any restrictive policies imposed in major markets, of which U.S. is most important, he said.

"And we must make this fact clear in season and out of season because as we are also far and away the most important market for manufactures of the United States, restrictive measures not only harm us but at once rebound and boomerang to their own detriment."

Canadians must, he said, view with concern any steps to curtail trade which in the end, means curtailment of productive capacity.

"Such steps (restrictive) are even more deplorable when they originate at home. It is particularly distressing to see legislation enacted in Canada designed to restrict mining development and export trade. One can only express the hope that this is a brief and temporary phase of sowing political wild oats and that the crop will quickly wither before it spreads to other provinces."

India Inagurates New Aluminum Mine, Smelter

IN MID-FEBRUARY, Dr. Harekrushna Mahtab, chief minister of the state of Orissa, India, officiated at the opening of the new Indian Aluminum Co. Ltd. smelter, an 11,200 ton-per-year plant which more than doubles the national output. Aluminium Ltd. of Canada has a 61% interest in the project, the rest of which is held by Indian shareholders.

Built at a capital cost of $10-million, the smelter forms part of a $30-million integrated expansion project involving bauxite, alumina, smelting and fabrication of aluminum.

The establishment of smelting capacity at Hirakud is based on the supply of electric power from the state-owned 165,000 hp Hirakud generating plant, and an expansion of the existing bauxite and alumina production facilities in Bihar State.

The Indian company plans to expand the Hirakud smelter to 22,400 tons capacity, and discussions are currently taking place with the Orissa government for the supply of the additional power required.

Partial expansion of the bauxite-alumina facilities has been completed, and further expansion would be undertaken concurrently with the smelter expansion, to meet the full requirements of the Hirakud smelter as well as the company's older 6,500 tons capacity smelter in Kerala State.

The Hirakud hydroelectric project is on the Mahanadi River.

Man in the News

J. R. Smallwood—Proving Up a Province

THE HON. JOSEPH R. SMALLWOOD, Premier of the Province of Newfoundland, is a man in a hurry. He believes fervently in the future of his province and is devoting an almost unbounded energy to bringing that future closer.

The most recent milestone was the announcement in February of the construction of a 42-mile railway from the Wabush Lake iron ore deposit in Labrador to connect with the Quebec, North Shore & Labrador Railway, which runs from Schefferville south to Seven Islands and the world's markets. (See p 18.)

But "J.R." isn't resting on his laurels. His vocation and avocation is the development of Newfoundland and the standard of living of its half-million inhabitants. In an interview with *E&MJ* (see photo) he checked off some of the highlights of recent progress:

Per capita income of Newfoundlanders has gone from 10th place in the list of 10 Canadian provinces to sixth;

New, diversified industries have been brought into the Province;

A mineral survey of the province has been flown at Government expense;

A climate for outside investment has already been created and will continue to improve.

The Premier's office at St. John's is now in a white painted building in the center of town which overlooks the tight little harbor which created the town and has helped support it since its settlement in about 1500, the first on the North American Continent. But the fishing industry is not enough to support Newfoundland today, and offers very little volume support for J.R.'s dream.

Premier Smallwood is aware of the mineral potential of Newfoundland, and, in any discussion shows a remarkable familiarity with mining, ore occurrences, shipping costs and mineable reserves. The Quebec-Labrador iron ore trough, which runs from Ungava Bay south to Mt. Wright (see map, p 18) is one of his particular favorites and an unwary interviewer can be inundated by the charts, maps and plans which the Premier produces, accompanied by a stream of facts and figures.

As an example of the Provincial attitude toward outside investment, the Premier cites the two corporations in which Newfoundland is a partner. The chief executive notes that government policy is generous in the matter of leases and taxes, but insists in a sharing of the profits outright.

The Provincial share of Brinco, the British Newfoundland Corp., is 8% of profits before taxes (there is a Canadian government tax). In the case of iron ore, the share is 22c per ton of salable product. Brinco is owned by some of

"Newfoundland seeks a partnership . . ."

the largest investment and mining firms of Europe and Canada, and operates from copper, uranium, and other nonferrous mineral leases in the area. It is also a producer of wood pulp and is devoting funds to harnessing hydroelectric energy at Hamilton Falls.

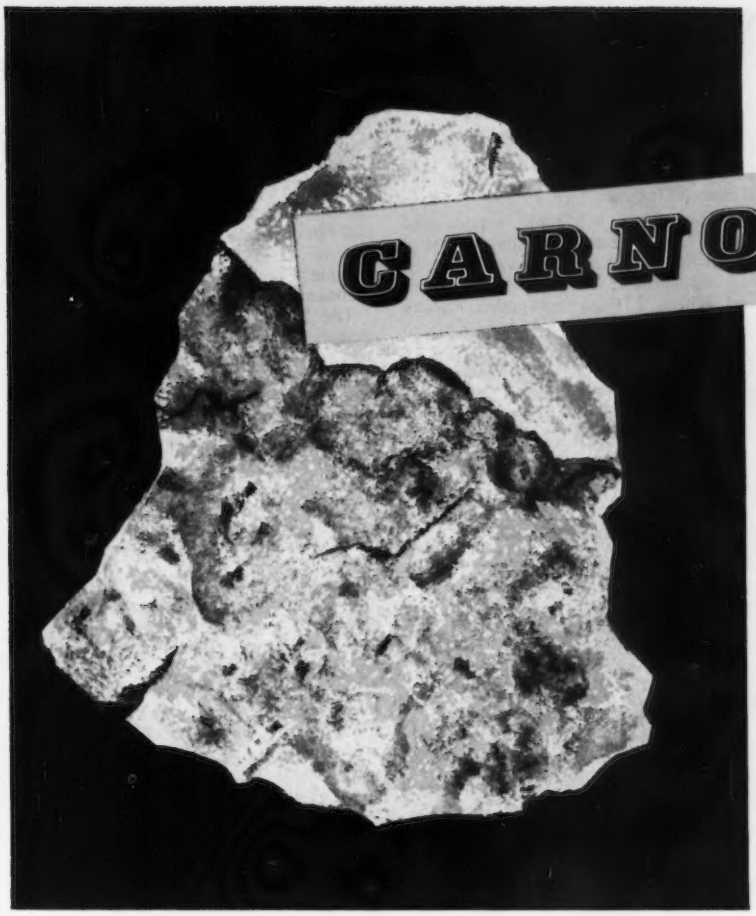
The second "partnership" firm is Nalco, the Newfoundland and Labrador Corp., which holds huge leases in Labrador and in Newfoundland. It, too, will operate under the 8% sharing plan.

Regulations on the holding of leases are a combination of liberal and firm. Lease time limits for exploration are sharply fixed by the government; leases on developed and developing sites are almost unlimited. Any operator who holds leases must "shed" those which he is not developing at a set rate each year, making them available for leasing to other operators.

The Nalco lease, for instance, consists of 24,774 square miles in the entire province. Wabush Iron and Javelin Corp. Ltd., which now control the company (51% and 43%), will shortly be beginning development of promising sites. One sixth of the Javelin leases are in the iron area along the Quebec border.

Premier Smallwood, who is the author of six books, began as a journalist in St. John's and later in the U.S. In his ten years of office, he has seen mineral production from Newfoundland doubled.—And now, in his third term, is planning for even more dramatic growth.

J.R.'s only hobby other than the Province "is a farm I run with my son." He was asked if he practiced scientific farming. "Well, sir, we like to think so!"



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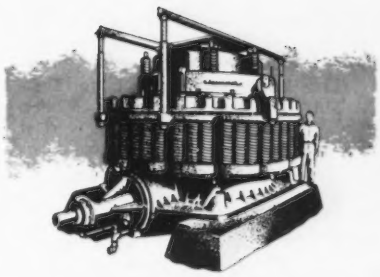

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THIS MONTH IN MINING (*Continued*)

Rock Mechanics Papers Listed For April

SPEAKERS AND SUBJECTS have been announced for the Third Symposium on Rock Mechanics to be held at Colorado School of Mines, Golden, Colo., on April 20 and 21, in association with the Universities of Minnesota and Pennsylvania. All half-day sessions will be at the Mines Library and each 20-minute paper will be followed by a 15-minute open discussion:

First Session—Theme: *Factors Common to Comminution, Underground Failures, and Failures Resulting from Explosions* Moderator: Fred C. Bond, consulting engineer, Allis-Chalmers.

"Influence of Stress Rate and Other Factors on the Strength and Elastic Properties of Rock"—Rudolph G. Wuerker, associate professor of mining engineering, University of Illinois.

"Studies of the Energy Requirements for Crushing"—Richard Zeleny, department of chemical engineering, Michigan State University (Co-author: Edgar L. Piret, science attache, U.S. Embassy, Paris).

"Correlation for Certain Canadian Rocks of Crushing Index Values with Underground Rock Failure"—L. E. Djingheusian, senior engineer, Canadian Dept. of Mines.

"The Role of Stress Waves in Comminution"—John S. Rinehart, director of mining research laboratory, Colorado School of Mines.

Second Session—Theme: *Factors Common to Soil Mechanics and Rock Failure* Moderator: Don L. Deere, professor civil engineering and geology, University of Illinois.

"Application of the Principles of Soil Mechanics to Open Pit Mining"—Stanley D. Wilson, consulting Engineer, Seattle, Washington.

"The European Approach to Slope Stability Problems"—Leopold Muller, president, International Association of Geomechanics, Köln-Sülz, Germany.

"Time Dependent Deformation and Failure of Geologic Materials"—H. R. Hardy, physicist, Canadian Department of Mines.

"The Mechanics of Rock Failure"—L. H. Robinson, Production Research Division, Humble Oil and Refining Co., Houston.

Banquet—Speaker: Dean Curtis L. Wilson, Missouri School of Mines and Metallurgy—"The Road to Survival."

Third Session—Theme: *Explosions and Seismology* Moderator: C. W. Livingston, president, Barodynamics, Inc.

"Calculation of Charge and Scale Model Trials"—Ulf Langefors, physicist, Nitroglycerin Aktiebolaget, Stockholm, Sweden.

"The Attenuation of Shock Waves in Solid Materials with Seismic Applications"—Donald R. Grine and G. R. Fowles, Poulter Laboratories, Stanford Research Institute.

"Propagation of Peak Strain and Strain Energy from Explosion—General Strain Pulses in Rock"—David E. Fogelson (Co-authors: Thomas C. Atchinson and Wilbur I. Duvall), Applied Physics Laboratory, Bureau of Mines, College Park, Md.

"Comparison of Griffith's Theory with Mohr's Failure Criteria"—D. P. Clausing, research engineer, Ingersoll—Rand Company.

"Recent European Research Work in Explosives"—Paper prepared by C. H. Johansson, Nitroglycerin Aktiebolaget.

Fourth Session—Theme: *Nuclear Blasts in Mining* Moderator: Robert Stephanko, Penn State University.

"The Earth"—Sir Harold Jeffreys, Cambridge University, England.

"Recent Results from Underground Nuclear Explosions"—Gerald W. Johnson (Co-author: Charles Violet), Lawrence Radiation Laboratory, University of California.

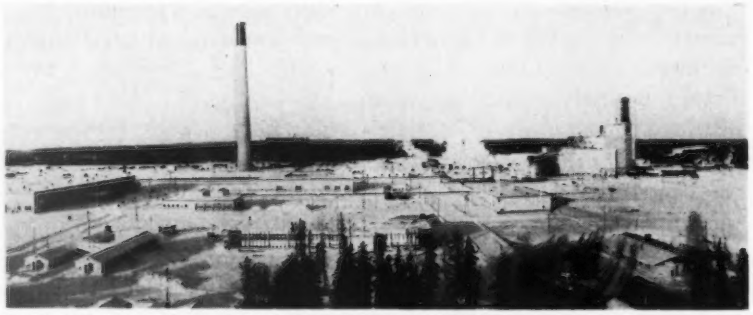
"Excavation with Nuclear Explosives"—Melvin Harrison (Co-author: Harry Keller), Lawrence Radiation Laboratory, University of California.

"Mechanical Properties of Ice"—T. R. Butkovich, physicist, Snow and Ice Basic Research Branch, SIPRE.

On Wednesday, April 22, tours will be conducted to the Schwartzwalder Mine and the School of Mines Experimental Mine.

On Thursday, April 23, the Colorado School of Mines will play host to the First Annual Soil Mechanics Conference sponsored jointly by the Soil Mechanics and Foundations Division, Colorado Section of the American Society of Civil Engineers and the Civil Engineering Department of the School of Mines.

The Third Symposium on Rock Mechanics is under the joint auspices of the Mining Engineering Departments of the Colorado School of Mines (L. J. Parkinson), Minnesota University (E. P. Pfleider) and Pennsylvania State University (H. L. Hartman). Members of the planning committee are: Lloyd E. Antonides, *Engineering & Mining Journal;* Maynard Ayler, Colorado School of Mines; Ulf Berg, Colorado School of Mines; Fred C. Bond, Allis-Chalmers; Wilbur I. Duvall, U.S. Bureau of Mines; Edwin J. Eisenach, American Metals-Climax; C. O. Frush, Colorado School of Mines; N. E. Grosvenor, Colorado School of Mines; H. L. Hartman, Pennsylvania State University; John M. Jones, Colorado School of Mines; C. W. Livingston, Barodynamics Inc.; L. J. Parkinson, Colorado School of Mines; E. P. Pfleider, University of Minnesota; John J. Reed, St. Joseph Lead Co.; John S. Rinehart, Colorado School of Mines; Arthur W. Ruff, Cananea Cons. Copper Co.; John F. Shaw, U.S. Bureau of Mines; Adolph Soderberg, Kennecott Copper Corp.; R. M. Stewart, Anaconda Copper Co.; H. K. van Poollen, Research Center, Ohio Oil Co.



THE WORLD'S SECOND LARGEST NICKEL MINE, now under construction by International Nickel Co in northern Manitoba, will begin production in late 1960. Capacity output of 75-million lb will be attained after a breaking in period.

Thompson Mine Moves Toward Production

AT YEAR-END, Inco's Thompson mine, in the Mystery-Moak Lake field of northern Manitoba, had shown remarkable growth from previous progress checks. Above photo was taken in December 1958. (See *E&MJ*, November 1957, p 72.)

Recent company announcements note that the railroad spur linking Thompson with CNR's Hudson Bay Line is providing year-round transportation for men, materials and supplies.

At the mine, 1,057 ft of development shaft and a 2,100 ft production shaft have already been completed and development of underground laterals is under way. Two hundred homes will be built in the first stage.

B.F.Goodrich

B.F.Goodrich Rock Service tires give coal company 30,000 miles before retreading

UTILITY COAL COMPANY operates a strip mine near Marion, Illinois. 25,000 tons of coal a month are hauled from pit to tipple over rough roads pocked with holes and large rocks. For this rugged work, Utility chooses B.F.Goodrich Rock Service tires—and no wonder. One set went 30,000 miles before retreading, has gone 8,000 miles since and has thousands of miles yet to go. Rock Service tires have minimized road delays, given maximum traction.

The Rock Service tire has a double chevron tread that grips the road in forward or reverse. The tread is specially compounded to resist rock cuts and bruises. And under the tread is the B.F.Goodrich FLEX-RITE NYLON cord body that withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. This is why the B.F.Goodrich FLEX-RITE NYLON cord body outwears even the extra-thick Rock Service tread, can still be retreaded.

If you want better tire service at lowest cost per mile, see the money-saving tires your B.F.Goodrich Smileage dealer has for every type of mining job. Look for your B.F.Goodrich dealer's address under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Enter the B.F.Goodrich Truck Tire Mileage Contest. You can win a Thunderbird or Corvette or one of 310 other prizes. See your B.F.Goodrich dealer for entry blanks.

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

B.F.Goodrich *truck tires*

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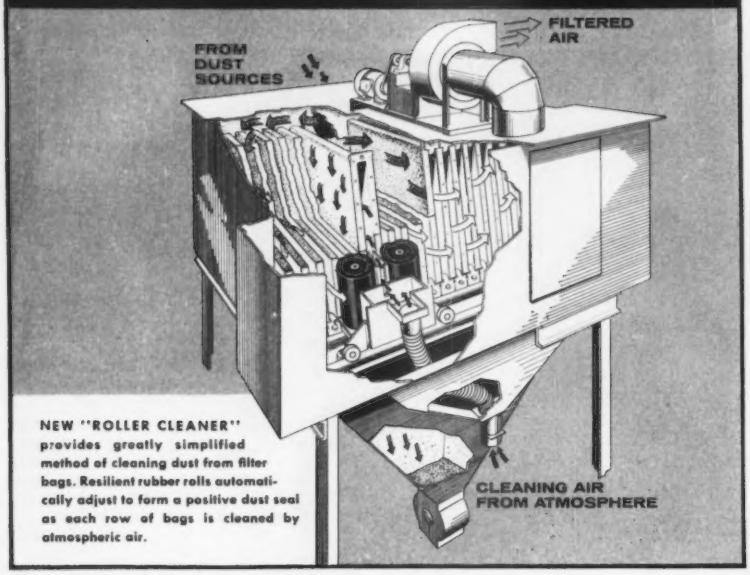
NEW *SLY* DYNACLONE® DUST FILTER


FILTERED AIR
FROM DUST SOURCES
NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.
CLEANING AIR FROM ATMOSPHERE

Patent Nos. 2583039, 2695681, 2867289. Other Patents Pending.

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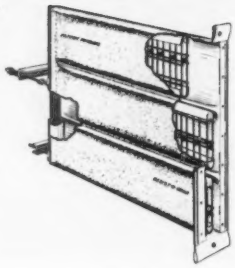

NEW SLY "RESIST-O-WEAR" FILTER BAGS (patent pending) provide complete dust filtration with as much as three times longer life than conventional bags. This has been proved on the toughest field installations.

The new bag has three equal-size sections. Each pocket has two spacers, making a total of six per bag. Weight is distributed on three seams rather than one, minimizing strain. A special protective flap on the back end prevents abrasion from incoming dust.

Now standard in the new "Roll-Clean" Dynaclone, Sly "Resist-O-Wear" bags combine with all the other superior Dynaclone features to assure greatest dust collecting efficiency with unequalled maintenance-free service.

ALL THESE FEATURES IN ONE DUST FILTER

- New "Resist-O-Wear" bags last as much as three times longer.
- Constant suction at dust sources—complete dust collection.
- Automatically self-cleaning for continuous operation.
- Free-rolling cleaner. Complete dust seal—automatic seal adjustment.
- Greater filtering capacity; smaller space requirements.
- Simplified construction for ease of inspection and servicing.

SEND FOR New Bulletin 105 and New 36-page Dust Control Catalog 104.

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South Korea and Thailand Are Air Survey Subjects

Two aerial surveys have been undertaken in the Far East under International Cooperation Administration programs, both involving aerial magnetometer surveys of mineral areas. Aero Service Corp., of Philadelphia, has announced completion of the first phase of a 10,000 square mile geophysical survey of South Korea, the first of its kind in that country. Approximately 3,500 square miles have been logged at an altitude of 500 ft since the program began in October 1957. Its basic objective is the enlarging of iron ore reserves in the Republic.

The second part of the program will take place in Thailand when the winter season blankets Korea. A combined magnetometer and scintillation counter study was to begin in mid-February over a 4,000 square mile area. Iron ore and radioactive elements are the targets for the survey, which is to be completed by mid-April.

Both surveys are being performed by a Piper Apache airplane, the first one in use for such work. Ferrying of the small plane across 8,300 miles of land and ocean involved careful fuel allowance by the Aero Service team.

Germans Announce Huge Iron Ore Discovery

THE WESER REGION of West Germany is the site of discovery of an iron ore deposit estimated to contain 400-million tons of 42- to 48% iron ore, according to sources in Bonn.

The discovery, at depths of 2500 and 4,000 ft, was made in connection with an oil survey which has been under way for two years in the section.

IN THE U.S.

ARIZONA

Arizona mining groups have joined in a campaign to investigate air pollution.

A. P. Morris, governor of the American Mining Congress and general manager of the Ray Division of Kennecott Copper Corp. told Arizona legislative leaders that the industry favors an impartial investigation by an appropriate state agency to determine the nature, sources, and extent of air pollution.

The mining industry has been a favorite target of anti-pollution forces who claim smelter smoke from Ajo, Douglas, Superior, Hayden, Miami, and Clifton pour into the low areas of Arizona and are responsible for the increase of smog-like conditions.

Former Senator Barry Goldwater (R. Ariz.) recently drew attention to smoke coming from Arizona's copper smelters as a possible cause of the pollution increase. Goldwater, who built a mountain-top home at Phoenix recently, observed "you can't see Phoenix much

NEW CONVEYOR DESIGN

(EXCLUSIVE WITH McNALLY PITTSBURG)

...means far longer belt life!
...slashes maintenance costs!

SECRET

. . . of the improved efficiency of this new belt conveyor. This new McNally Pittsburg Cradle Idler* consists of 5" rubber rollers assembled on precision ball bearings, prelubricated, lifetime sealed. Being a *true catenary* suspension with rollers mounted on flexible, *non-rotating*, stainless steel wire rope, this design eliminates "loping" and harmonics.

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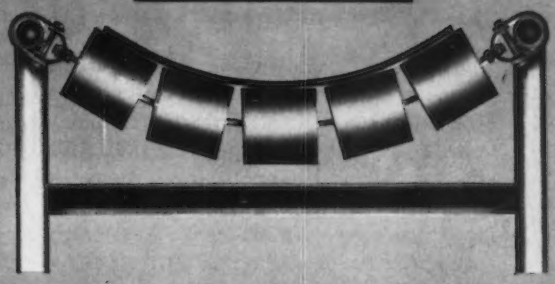

. . . is greater capacity and faster belt operation with minimum spillage. Since the belt lies in true arc with no creases or bends to cause wear, *belt life is substantially increased*. Because this unique McNally Pittsburg conveyor design is so simple, maintenance costs are lower; over-all erection time is reduced to a minimum as well.

For do-it-yourself construction, the entire conveyor is shipped disassembled and may be put together in the field to fit your conveyor needs. Also, a new "SHORTY" conveyor is available, only 2 feet high, ideally suited for use in limited working areas, above or below ground.

Write today for full details and information on this new, remarkably efficient, McNally Pittsburg Conveyor. Its new design cuts installation costs—and saves you money on belts and maintenance.

*Patents Pending

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☐ Please send information on the new McNally Pittsburg Belt Conveyor.

☐ Have Sales Engineer call for further consultation.

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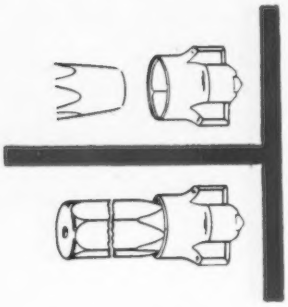
the tungsten carbide bit that needs no resharpening

Patents applied for

Fast drilling—long life—low first cost—low cost per foot of hole drilled

The exclusive, shallow, long-life inserts need no resharpening because they do not develop a reverse taper dullness . . . a condition that stops drilling in the conventional multi-use bit. The exclusive design of LIDDICOAT permits fast drilling far beyond the point where conventional multi-use carbide bits must be withdrawn from service for resharpening. Fast drilling continues during the entire bit usage without need of resharpening.



Taper socket — No threads — Fast, firm attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new, short-taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.

Forged for toughness from nickle alloy steel

Bodies for Liddicoat bits are produced by forging. By a patented manufacturing process, the alloy steel is subjected to tremendous pressure which extrudes it into the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the material gives Liddicoat bits an unusually strong structure.

WESTERN
Rock Bit
Manufacturing Company

552 West 7th South Salt Lake City 1, Utah

Arizona *(Continued)*

of the time." And as pilot of his own airplane, he noted that rivers of smelter smoke frequently can be seen pouring into Central Arizona. He offered to take investigation leaders aloft so they could see for themselves.

Morris called attention to the soaring populations of Phoenix and Tucson as causing increasing concern about air pollution.

A legislative bill has been readied, calling for $25,000 to be spent on investigation.

Arizona's bureau of land management has undertaken the monumental task of locating an estimated 13,000 claim holders within the Papago Indian Reservation in Southern Arizona.

The project was initiated as a result of Public Law 47 which withdrew the Papago lands from mineral entry under the mining laws and authorized their being held in trust by the U.S. for the Papago.

Boundaries of the reservation include approximately 2.75-million acres in parts of Pima, Pinal, and Maricopa Counties.

CALIFORNIA

Production at barite claims owned by Emil Ritter 15 miles east of Caliente is expected to get under way during the first part of April. Coring started early in the fall. A road is being bull-dozed into the rugged mountain area. Grades reach 10% in places.

The main shaft at the Little Sparkler mine in Kern River Canyon has reached the 150-ft level in an effort to further prove and delineate uranium mineralization.

N. A. Coproni of the Mineral Exploit Co., Blythe, is planning to develop a uranium property in the McCoy Mountains. In recent months Coproni has been participating in the Government's carload manganese program, treating uranium as a sideline. He indicates that the time has come to go back into uranium.

COLORADO

Rico Argentine Mining Co., controlled by the Hogle interests of Salt Lake City, has announced reopening of the concentrator and resumption of lead-zinc mining at properties in Colorado's Rico district.

The mines have been shut down for the past 18 months because of metal prices.

The company's principal activity in the interim has been the mining of iron pyrites, which it converts to sulphuric acid for sale to uranium mills in the area.

L. R. Birch, Rico mine superintendent, said that in the process of mining the pyrites, Rico has uncovered a number of "pods" in an amount sufficient to

CHEWING BLAST HOLES AT HILLS CREEK DAM. Bethlehem Hollow Drill Steel bores 10-ft holes as 1,000,000 cu yd of tuffaceous rock is removed to make way for Hills Creek Dam. On the Middle Fork Willamette River in Oregon, the earth-and-gravel structure, 1920 ft long and 335 ft high, will store water for both flood control and power generation. Supervisory Authority: Corps of Engineers, U. S. Army; Contractors: Green Construction Co. and Tecon Corp.; Drill steel supplier and reconditioner: Senter Tool Service.

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1¼" thru 6"	10-1500 GPM	up to 100 feet

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Sizes	Capacities	Heads
2" x 2½" thru 6" x 8"	50-1600 GPM	up to 100 feet

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Sizes	Capacities	Heads
1½" x 2" thru 8" x 10"	20-3600 GPM	up to 120 feet

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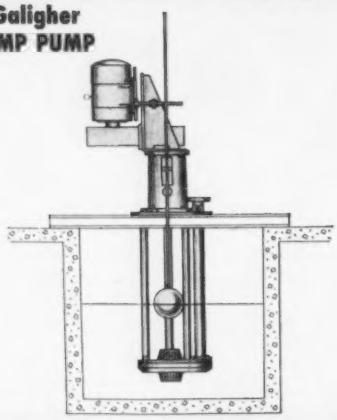
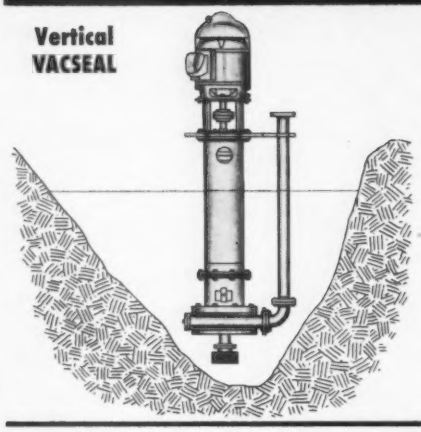
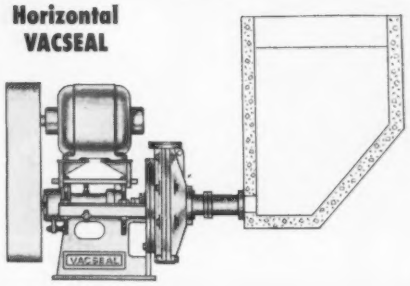


VACSEAL PUMP

Vertical VACSEAL



Horizontal VACSEAL



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Colorado *(Continued)*

reopen the mill for the time being.

Mining from orebodies existing prior to the price slump will not be resumed at this time.

Birch said that some of the ore pods assayed as high as 70% lead. Some 75 persons are employed currently in pyrite and sulphuric plant operation at Rico. The resumption of mining and milling will add 50 employees. Lead concentrates will go to Tooele, Utah, smelter of International Smelting & Refining Co. (Anaconda Co.) while zinc will go to Anaconda's Great Falls, Mont. plant.

The Bureau of Mines reports that the beryllium industry of Colorado was extremely active during 1958, primarily in Larimer County, where Mineral Concentrates, Inc. built a 50-tpd mill and a beryllium-hydroxide plant designed to process five tons of beryl concentrate per day. The American Beryl Corp. also constructed a 50 tpd plant. In addition, Estes Park Beryllium Corp. announced plans for the construction of a 200 tpd mill 2½ miles north of Drake.

Another beryllium highlight in 1958 was the development of the Chaffee County Mt. Antero beryl deposit by the Cyac Consolidated Mining & Development Co. This company is an affiliate of Antero Refining Co. which constructed a beryllium oxide plant three miles west of Poncha Springs. Antero Refining Co. plans to produce ceramic grade material from Mt. Antero ore as well as from purchased ore.

The Beryl Ores Co. of Arvada continued to be the principal processor of Beryl ore in Colorado and the major shipper of beryl and beryllium products from the State to U.S. consumers. The company operates a plant at Arvada using beryl and other pegmatite minerals purchased from local miners.

The Boomer mine near Lake George continued to be the principal source of beryl in Colorado during 1958. The operation of the mine was taken over by the Mile High Oil Co. toward the end of 1958.

Considerable activity in thorite mining was noted in Colorado during 1958 by USBM. Wah Chang Corp. purchased thorite ore and concentrate for processing at its mill near Sugarloaf, Boulder County. The company produced a 10 to 15% thorite concentrate which was shipped to the East Coast. The Anna Lee and Beardsley properties in Fremont County and the Star in Custer County were the principal producing mines.

The future of mining in San Juan County looks more favorable this coming year than for the past ten. Prospecting for higher grade ores and precious metals has been more active the past eight months.

Discovery of a good grade of gold ore in the Clear Lake section last summer may prompt major activity there. The Denver Golden Co. has the property and reportedly adequate finances to operate it.

In recent weeks, the first high grade uranium ore was shipped from the area

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Colorado *(Continued)*

to a mill near Gunnison. The ore came from the Long mine at Elk Park, operated by Clyde Long. Mining continues there at present time with new veins showing up. Two years ago uranium of comparable grade was unheard of in this area or at this altitude.

The Pride mill is the only operating mill in the county, employing a number of local miners and mill men. Work here may be expanded in the summer. The Pride is well known for its rich silver and lead ores.

Marcy-Shenandoah Co. has the largest mill in the country, all in first hand order. It is capable of handling large tonnages and has an excellent recovery record on most types of ore from this county. This company has reserves in the Shenandoah mine and Silver Lake property, the latter being under lease. It is reported this company will start mining operations there early in the spring.

U.S. Bureau of Mines experiment station at Salt Lake City has completed amenability tests on Front Range ores and forwarded the reports to Grand Junction Operations Office of the Atomic Energy Commission. AEC has delayed making award of a concentrates purchase contract in the district to one of two contending parties until the Bureau of Mines concluded its work.

The Bureau tests an assortment of ores in various mixtures on basis of responsiveness to acid or alkaline leach process.

Golden Cycle Corp. and United Western Minerals propose to convert Golden Cycle's old 200 tpd Carlton, Colo. (gold) mill to a uranium concentrator. Cotter Corp., which has a pilot plant in the district, also has a proposal before AEC to build a 200 tpd mill. On basis of reserve allocation handed the district, one 200 tpd processing plant would suffice.

Frank Richardson of Ouray has been working at the Brooklyn mine, where he has built a new road from Red Mountain pass. Next summer he hopes to construct a two-mile road from the Burro Bridge crossing.

Richardson, who also owns the Little Fanny mine, has been working 8 to 10 men the past summer. He presently has a crew of seven. He expects to reopen the Little Fanny and drive to the end lines of the property. He will then start drifting on some veins cut by the crosscut. He has great hopes for this old mine which was once a great producer of gold, silver and copper ores.

Declining world prices for silver shot its receipts at the Denver Mint up to 7,547,-452 oz in 1958 from a mere 177,942 oz the year before, mint officials report.

Value of receipts was up to $6,829,742 from $160,943. Rising prices toward the end of 1958, however, again reduced receipts to 19,597 oz worth $17,711 to December. In December 1957, receipts were 15,779 oz worth $14,204.

Gold receipts from mines were up a little last year; to 711,454 oz worth $24,900,917 from 707,043 oz worth $24,-746,489 in 1957.

December receipts of gold were up to 55,623 oz worth $1,946,813 last year from 50,630 oz valued at $1,772,046 in 1957. Present gold holdings of the Denver Mint are fairly stable at around $6-billion.

An unrestricted gift of $10,000 has been contributed to the Colorado School of Mines Foundation, Inc. by American Metal Climax Foundation. Morse Brothers Machinery Co. a Denver firm, has made its third contribution of $1,000 to the Colorado School of Mines.

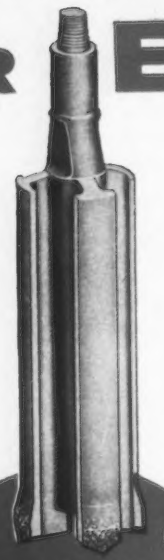
FLORIDA

Reopening of the Red Level dolomite mine north of Crystal River is expected shortly, following shutdown since 1942. The property, leased to Polk County Fertilizer Co., will be worked by dragline. Bulldozers, trucks and the dragline were moved into the property in mid-January.

IDAHO

Calera Mining Co. planned closure of its Cobalt mine and mill in March and the

FABRICATED STAR BITS



The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.

Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.

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Here is a Fabricated Star Bit that has been successfully proven on numerous large hole projects. It is available in a wide range of diameters, and weights . . . the lengths in which they can be furnished are directly related to their overall weight.

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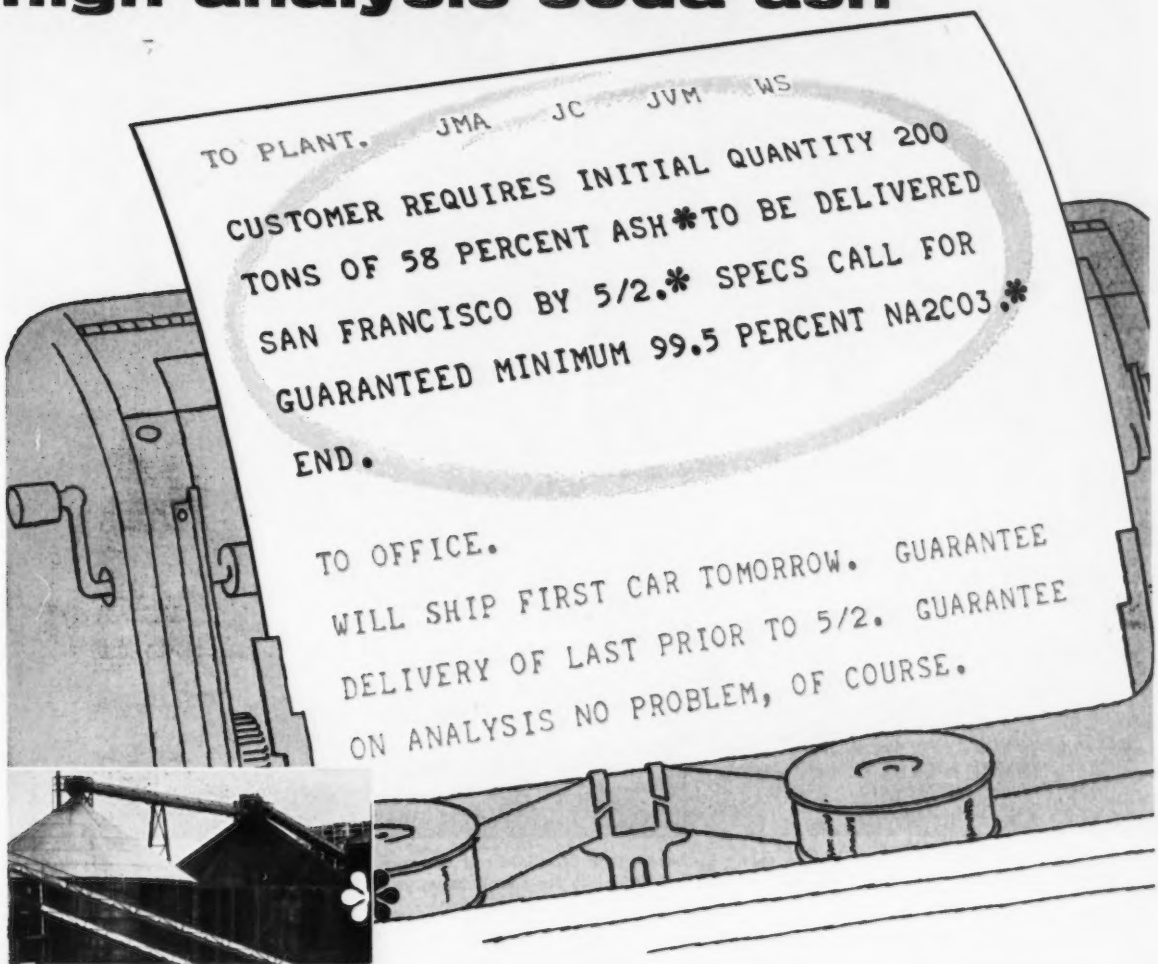
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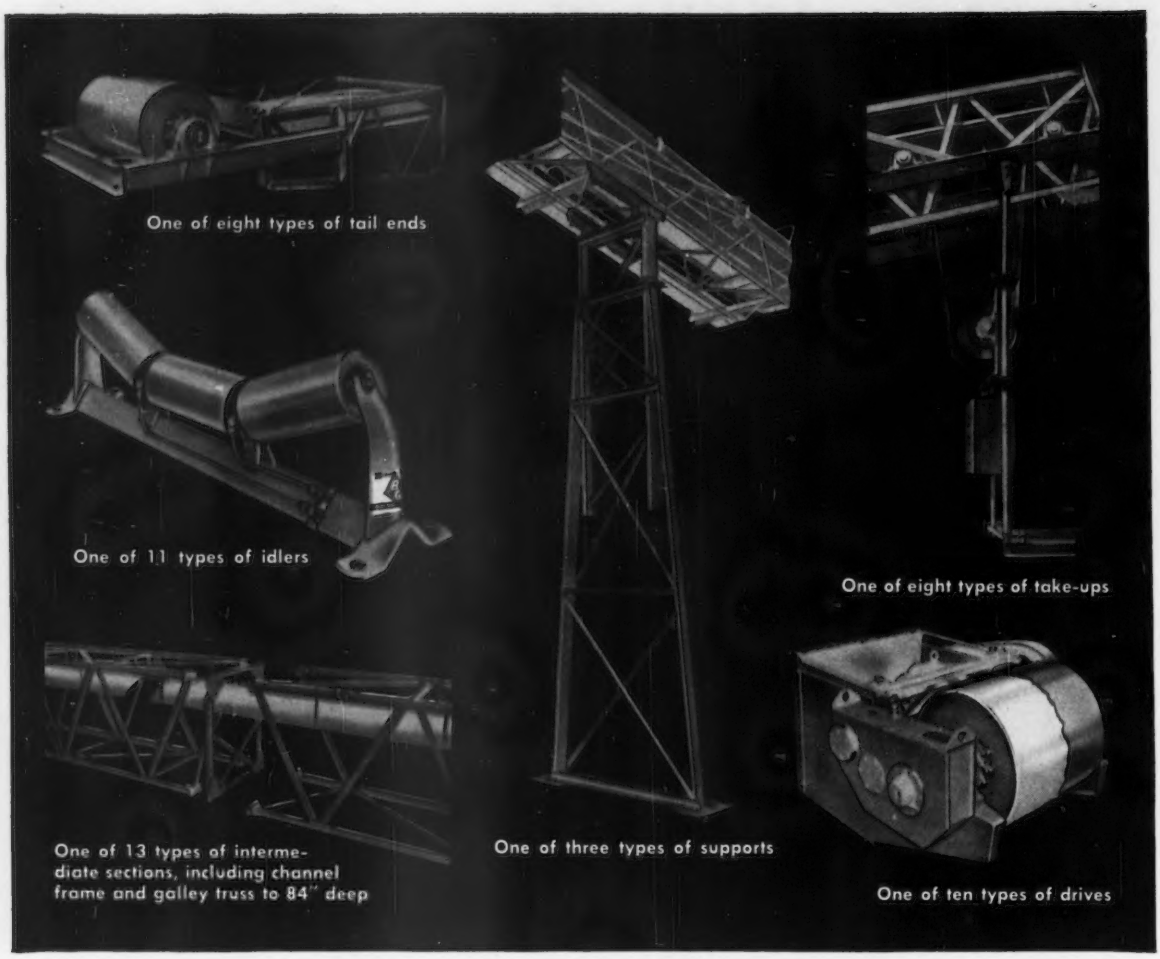
One of eight types of tail ends
One of 11 types of idlers
One of 13 types of intermediate sections, including channel frame and galley truss to 84" deep
One of three types of supports
One of eight types of take-ups
One of ten types of drives

Pictured here are just a few of the many Barber-Greene standardized conveyor components. Each is available in a wide variety of types and sizes, with unmatched flexibility for countless ways of assembly. Write for new bulletin.

Boost conveyor efficiency and cut costs with Barber-Greene standardized components

Every year, more and more belt conveyor installations — long and short, simple and complex — are made up of Barber-Greene standardized, "packaged" components. This standardization means fast, off-the-shelf delivery . . . almost limitless combinations of assembly that cut time and costs on any bulk material handling job . . . components completely interchangeable . . . spare parts readily available . . . simple selection and pricing right from the catalog. Light or heavy, Barber-Greene has the complete conveyor installation you need.

You save these six ways:

- **You save special engineering time and expense.**
- **You save delivery time.**
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- **You save on replacement costs.**
- **You save down time.**

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CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

Idaho *(Continued)*

Garfield, Utah, electro-winning cobalt refinery by July 1, 1959.

Edwin B. Douglas, mine and mill manager at Cobalt and C. F. Gommel, manager of the refinery, both report that only action by the Federal Government to extend its purchasing of cobalt or provide relief from foreign imports would prevent the closure.

There are some 135 employed at open pit sector of the mine, although in all 400 persons worked the properties until undergound mining was suspended several months ago because of cost factors.

About 130 are employed at the refinery.

Calera, a wholly-owned subsidiary of Howe Sound Co., has invested more than $12-million in mine, mill and refinery.

Gommel and Douglas said that Calera could not compete with foreign imports of cobalt, which sell for as low as $1.75 a lb. They are hopeful that Congress will provide a $1 import tariff.

Such legislation recently was introduced. Calera's contract with GSA for $2.30 a lb is now expiring.

The Spokane (Wash.) office of the Bureau of Mines has announced plans for two basic research projects in mines of North Idaho this year. One is a study aimed at new and better ways of accomplishing rock fragmentation, and the second is a fundamental study of the pressures and stresses encountered in deep mines such as those of the Coeur d' Alenes in Idaho and the Butte area.

Rare Metals Corporation of America reports doubt that it can continue operations of its open pit mercury mine at Wieser because of the present low price of quicksilver. Another Idaho operation in a precarious position because of governmental failure to act in preserving vital segments of the American mining program is the Calera mine in the Blackbird section of Lemhi county which faces the distinct possibility of a shutdown when the Government's present guaranteed price on cobalt expires July 1.

Bunker Hill Co. of Kellogg has contracted with the Dorr-Oliver Co., of Stamford, Conn., for preliminary engineering, process design and layout for the $10-million fertilizer plant Bunker will build in the northwest this year. William G. Hewitt, Bunker Hill marketing analyst, and LaVern M. Griffith, manager of Bunker's plant services division, went to Stamford to complete plans for the project.

The director-approved agreement between the Bunker Hill Co. and Yreka-United Inc., for deep development of Yreka's big block of ground in the west end of the Idaho Coeur d' Alene district's silver belt gained stockholder ratification at a special meeting of Yreka-United shareholders in Kellogg. Stockholders were told that Bunker Hill will resume work soon in an 18,000-ft crosscut that will eventually connect underground workings of the Crescent mine on Big Creek, four miles east of Kellogg, with the Bunker workings in Kellogg.

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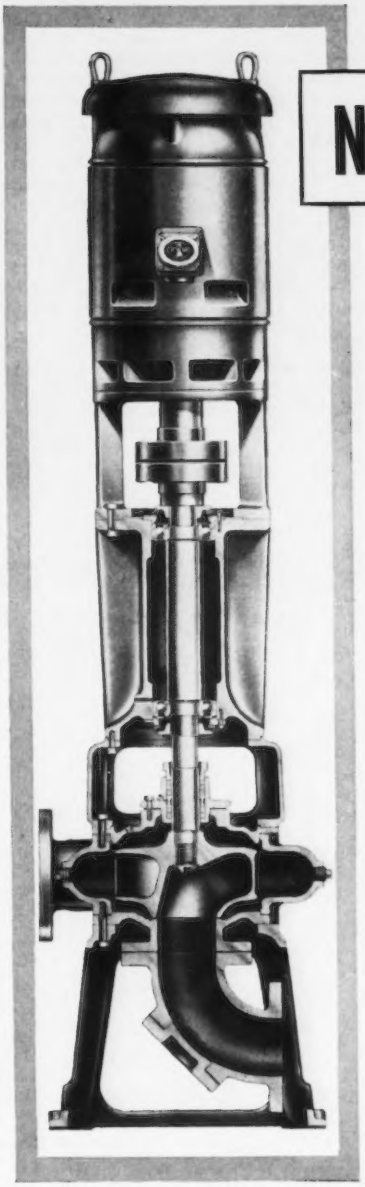
of solids in suspension!



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Idaho *(Continued)*

Henry L. Day, president and general manager of Day Mines, Inc., announced that Day Mines operations in 1959 would probably be confined to its two producing mines, the Dayrock and Hercules, the company's 25% participating interest in the Galena mine of American Smelting and Refining Co., and the Gold Dollar gold property in Ferry county, Wash. He said the company has made no future exploration commitments except at the Dayrock. "There," Day said, "we will soon take a look at two new blocks of ground lying to the west of the previously productive areas. These blocks have been caused by substantial faulting. Our probe of this fertile territory may consume eight months time at an average monthly expenditure of $7,000 to $8,000."

American Smelting and Refining Co. is accentuating Idaho operations at its Galena mine near Wallace and will continue a "relatively aggressive program there during the year," J. C. Kieffer, northwestern mining department manager, stated at Wallace. He said the company will continue to sink the main shaft at Galena, cut a 3700-ft station as they proceed with shaft sinking operations and continue on down to the 4,000-level. Installation of additional ventilation openings is also planned at Galena, Kieffer said.

At the company's Page mine, near Kellogg, where operations were recently restored to a five day week basis after eight months of four-day work, Kieffer said development work is again being picked up and he said the main shaft, allowed to fill with water to the 3070 level, has been unwatered to he 3400 and crosscutting from that level to the rich Tony Vein has been resumed. Kieffer said Asarco has no plans to step up operations at its old Morning mine near Mullan, Idaho.

Bunker Hill Co. and Day Mines, Inc., and five Washington companies, Pend Oreille Mines and Metals, Grandview Mines, Metaline Contract Mines, Metaline Mining and Leasing and Metaline and Pine Creek Consolidated, are among western firms that have signalized their intention to oppose proposed construction of the Boundary and Z-Canyon dams on the Pend Oreille river in Washington when the matter comes for hearing before the Federal power commission in Washington, D.C., this spring. Their opposition is based on the premise that water backed up by these proposed dams will flood present mining operations and forever blot out the Metaline area as one of the nation's great potential reserves of lead and zinc.

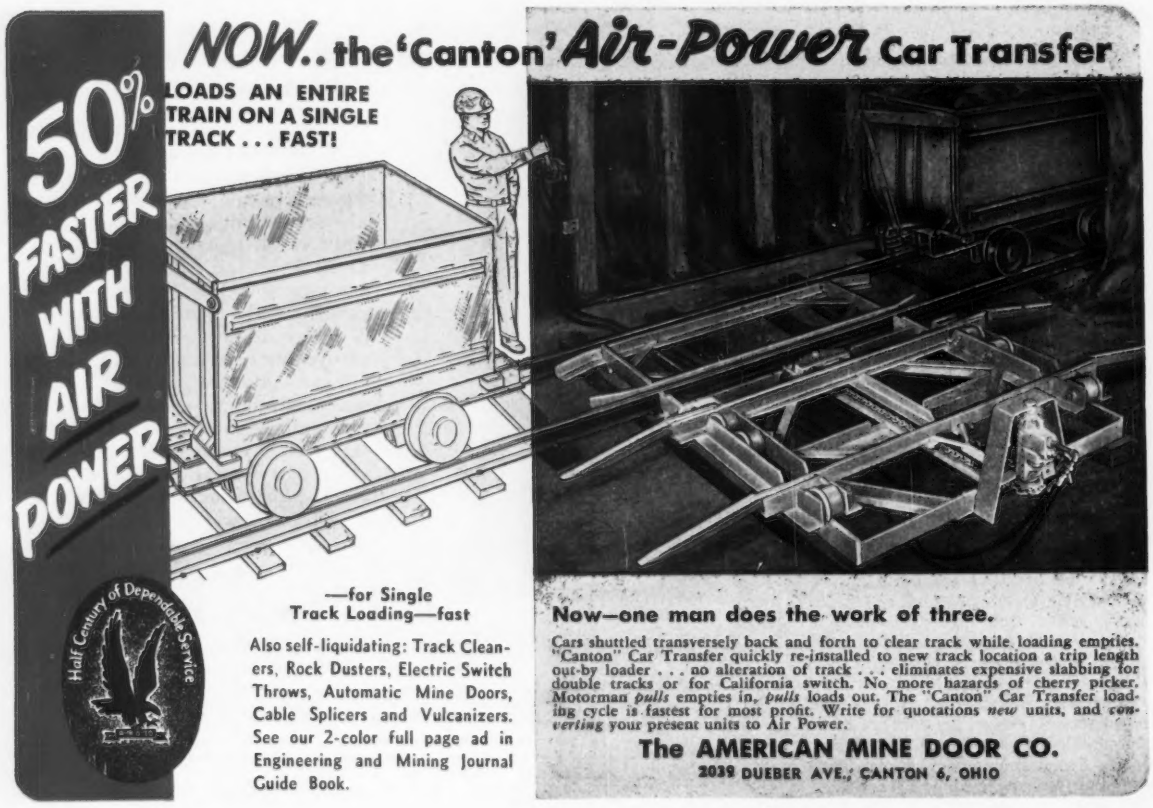
Hecla Mining Co. of Wallace reports an "assist" by Newmont Mining Co. in Hecla's acquisition of Lucky Friday Silver-Lead Mining stock under terms of a 30-day agreement announced Dec. 15 whereby Hecla agreed to pay $7.50 per share for all Lucky Friday stock that holders chose to turn in to Hecla after that company had originally acquired 184,000 Lucky Friday shares from two Lucky Friday officials, Charles E. Horning, president, and John A. Featherstone, vice president. When the expiration date arrived Hecla had picked up 503,130 shares of Lucky Friday and Newmont, 140,394 shares, for a total payment of $4,826,430 to stockholders, most of whom live in Northern Idaho and Eastern Washington.

Hecla president L. J. Randall said Newmont entered into the deal when assistance was deemed necessary by Hecla in the event shares were offered in large amounts beyond Hecla's means to finance.

Two "hard rock" miners of the Coeur d' Alenes are now in office as Idaho state mine inspector and deputy inspector. They are George D. Fletcher, Mullan, elected in the November balloting, who is a former American Smelting and Refining Co. contract miner, and William Burlon, Mullan, his deputy, who had been an underground worker at Lucky Friday Silver-Lead Mining Co. in Mullan since 1955.

The Idaho State Land Board has granted its first iron ore mining lease to Frank Milbert and M. L. Darrow, both of Potlatch.

The lease, located in Latah county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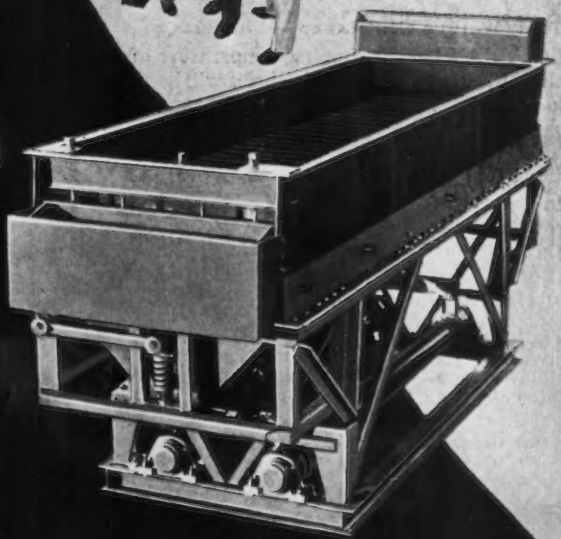

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POLYMAX is the National Filter Media Corporation's name for filter media manufactured from the new olefin polymers known as "low pressure", "linear", "high density", or "high crystallinity" polyethylene.

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Fabrics manufactured of these new polymers have physical properties which are truly remarkable, when compared to conventional polyethylene or when compared to nylon. Tensile strength and resistance to stretching or elongation are important characteristics of filter media. The following table tells the story.

	Nylon high tenacity	conventional Polyethylene	POLYMAX
Tensile Strength PSI	89,000 to 108,000	11,000 to 35,000	50,000 to 150,000
% Elongation	19 to 24	20 to 80	10—med. orient. 5—high orient.

Physical Characteristics

Filter fabrics will be woven of monofilaments to duplicate existing monofilament Saran and Polyethylene fabrics. Fabrics woven with very fine monofilaments as well as multifilaments are under development.

Temperature Resistance — Shrinkage

POLYMAX has a softening temperature of 260°F and is sterilizable at 250°F. POLYMAX fabrics will be finished so that exposure to temperature in the 230°F-240°F range will result in minimum shrinkage.

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In general POLYMAX filter media equals or exceeds the chemical resistance of conventional Polyethylene. Tables for chemical resistance of Polyethylene can be used. POLYMAX shows markedly less effect of immersion in Chlorinated hydrocarbons, gasoline and lubricating oil.

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Idaho *(Continued)*

in north central Idaho, covers 160 acres of land. A royalty of 2½ to 12½% production, depending upon the value of the ore, was specified.

Tests of a 10-ton sample of thorium ore from Agency Creek Thorium Corp. are being run at Salmon. Clinton A. Gundersen, a director of the firm, located at Mackay, notes that the ore is mined along a footwall of a vein 22 ft wide and approximately 300 ft along the surface. The firm is working towards proving 400 tons of 3% or better to justify construction of a 100 tpd mill. Agency Creek's claims are in the Lemhi Pass area.

ILLINOIS

Tamora Mining Co. has suspended operation at both the Eureka and the North Daisy fluorspar mines, according to announcement by Wiley Cochran, company owner. The properties are leased from Rosiclare Lead and Fluorspar Mining Co. Twenty-six employees were laid off, effective Jan. 28, but Cochran plans tentatively, depending upon market conditions, to re-open in April.

A general inspection of Mexico's flourspar areas is being made by an Aluminum Co. of America geology and engineering party, according to Walter S. Skeels, Alcoa Works Manager at Rosiclare, to determine if the district offers any site of interest to Alcoa for some possible future investment. Those in the reconnaissance party are Jack H. McWilliams, geologist, Pittsburgh; Gilbert Smith, geologist, and Ronald Schaefer, mining engineer, Rosiclare; and John Meador, geologist, of Bauxite, Ark.

Gill Montgomery, vice president and general manager of Minerva Oil Co., Fluorspar Division, of Eldorado, representing independent fluorspar producers, addressed the National Western Mining Conference in Denver Feb. 5 to 7 on the subject, "Domestic Fluorspar: Its Problems Continue."

Citing the bleak outlook confronting the domestic industry as a result of foreign importation, Mr. Montgomery emphasized the need for specific relief and asserted that no such relief is presently in view. Even in a downward market such as 1958, producers still lost most of domestic consumption to importers, and legislative relief in the form of quota limitation, increased tariff or resumption of stockpiling is essential to the life of the domestic industry, the speaker asserted. With the end of Government stockpiling on Dec. 31, practically all mining operation in the Ill.-Ky. fluorspar district is at a standstill although a few producers continue operation on a drastically reduced schedule with widespread unemployment throughout the area.

Domestic shipments declined in 1958 with an estimated total of 322,000 tons, which included 170,000 tons of acid,

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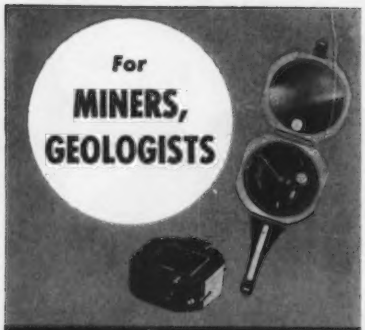

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Illinois (*Continued*)

22,000 tons of ceramic, and 130,000 tons of metallurgical grade, compared with 329,000 tons in 1957, according to Mr. Montgomery.

Imports last year totaled an estimated 390,000 tons, including 270,000 tons of acid grade and 120,000 tons of metallurgical grade, down from 631,000 tons, an all-time high, in 1957.

Estimated figures on 1958 consumption showed 267,000 tons of acid grade, 37,000 tons of ceramic, and 181,000 tons of metallurgical grade for a total of 485,000 tons, a decrease from a 1957 total of 645,000 tons.

Mr. Montgomery summarized industry developments and declared that national fluorspar reserves have never been higher.

Other scheduled speakers on the Fluorspar Section program were John L. Sloop, chief of Rockets System Branch of the National Aeronautics and Space Administration, Cleveland, Ohio; discussing fluorine as a rocket oxidizer in space flight; and Dr. John F. Gall, assistant manager of Research and Development Dept., Pennsalt Chemical Corp. of Philadelphia, who talked on the uses of fluorspar in the chemical industry.

J. Blecheisen, of Rosiclare, Ill., president of Rosiclare Lead and Fluorspar Mining Co., Fluorspar Section chairman of the Conference, set up the program and introduced the speakers.

MICHIGAN

The new Homer-Wauseca mine shaft has reached bottom at 2850 ft. A few months will be required for the Walsh Construction Co. to complete its contract. M. A. Hanna Co. expects the shaft to be in operation serving the two mines by next fall. The 20 ft diameter, concrete lined shaft contains two skip compartments for hoisting ore, a cage compartment with a 50 man multiple deck cage, three counterweight compartments, ladder road and pipe compartment. A Koepe hoist with counterweights will be installed in the shaft house.

During the sinking, an 8-ton drill rig with four pneumatic drills put down about 80 holes to an average 9 ft depth using 10 ft drill steel with 1⅞-in. bits. 500 lb of powder were used to load each cut. An 8 ft long Eimco loader did the mechanical mucking in about 12 hours.

Jones & Laughlin's Michigan Ore Division shipped 350,723 tons from its Tracy mine at Negaunee on the Marquette range in 1958. This compares with 467,380 tons produced in 1957, and 405,604 tons in 1956.

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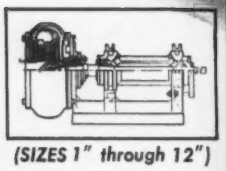

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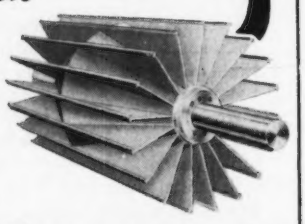

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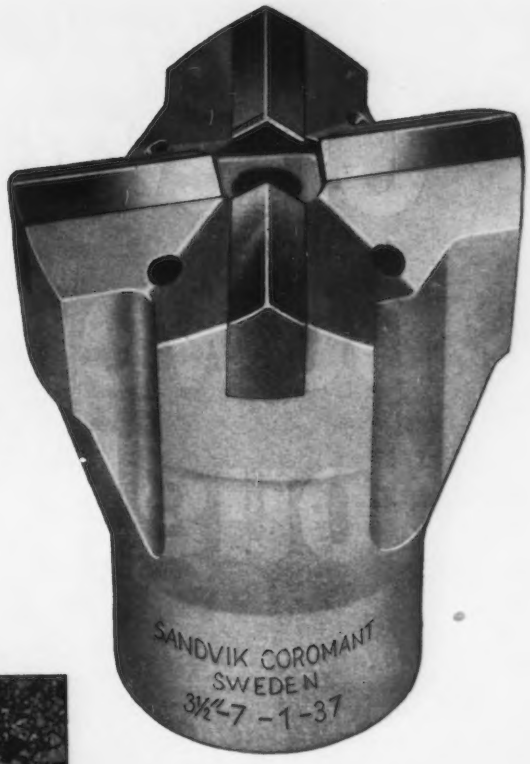

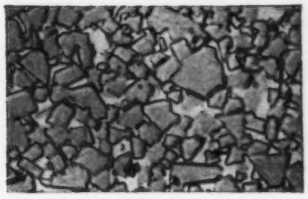

Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.

Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

1 Only first-quality tungsten carbide is used —as shown in the microphotos above. This means less wear, longer life and a better job.

2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.

3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels — the most widely used in the world — and Sandvik Coromant extension steel equipment.

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Type	Thread	Available Diameters, in Inches															
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SHOULDER	TAPER	x	x	x	x													
	F		x	x														
	113		x															
	H			x	x	x	x	x		x								
	115			x	x													
	D						x	x	x	x	x	x	x	x				
	K													x	x	x	x	
BOTTOMING	1" Rope				x	x	x	x		x								
	1¼" Rope						x	x	x	x		x		x				
	400						x	x		x		x						
	1½" Rope											x	x	x	x	x		
	600											x	x	x	x			
	700													x	x			
	J 7.5															x	x	
	2" Rope														x	x	x	x
	1000																x	

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That Series 100 Chevy tandem above takes a terrific pounding as it hauls huge loads of gravel or fill dirt into the heart of California's redwood country. It goes miles off the road, makes up to 24 trips a day through rocky forest land. Yet owner Bernard Conti, of the Conti Sand & Gravel Company, reports only one hour of downtime in 20,000 miles on this truck-killing road construction job. And Chevy's tough power gets the truck through faster, Mr. Conti says; assures more trips—more profits—per day!

Hauling outsized loads of fill dirt through California's forests calls for a heavy-duty truck that's rock-rugged and powerful as they come; one that's soundly built down to the last bolt. And the Conti Sand & Gravel Company bears witness to the fact that Chevrolet is just such a truck. They're completely satisfied with their Series 100 model, from the dependable pulling power of the big 230-h.p. Workmaster V8 to the work-whipping qualities of the tough-built chassis components. And you'll be equally satisfied with whichever Chevy heavyweight or middleweight *your* work requires!

Mr. Conti indicates that Chevrolet's Powermatic* transmission is of special importance in this rugged service. It helps him to bull through the tough spots with exceptional ease. This fully automatic 6-speed transmission virtually eliminates manual gearshifting! It also provides a Hydraulic Retarder that helps you control truck speed and saves wear on the service brakes.

**Optional at extra cost, Series 50, 60, 70, 80, 90 and 100 models.*

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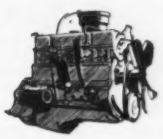
Chevy's powered to cut costs and keep going on your tough off-the-road hauls!

That's for *sure*, whether you use mighty middleweights or high-capacity heavyweights—whether you prefer V8's or 6's.

Take Chevrolet's 1959 big-truck V8's, for example. As indicated by that tough truck job pictured above, these modern engines are out to whip any work that comes their way. They've got what it takes to do it. The *shortest piston stroke* of any comparable truck V8's: a sure sign of more work on less fuel. Compact design that cuts down on truck weight and helps assure the biggest possible payloads. Scores of up-to-the-minute features that know how to trim overhead: full-flow oil filter, hydraulic valve lifters, hard-faced exhaust valves and hardened valve seats, extreme-duty Moraine 400 bearings, rotor-controlled governor, overspeed warning light and many more.

And with a *complete* lineup of modern V8 powerplants—including 160-h.p. Trademaster, 160-h.p. HD Taskmaster, 175-h.p. HD Super Taskmaster, 185-h.p. Workmaster Special and 230-h.p. Workmaster—Chevy can match the engine to your work, ideally.



Or if you prefer 6's, Chevy's *still* your best bet. Standard in Series 40 models is the 135-h.p. Thriftmaster 6, better than ever for '59 with a new Economy-Contoured camshaft that improves gas economy by 10%! And in Series 60 there's a new edition of the 150-h.p. Jobmaster 6. It offers new durability stemming from new tougher built pistons and Stellite-faced exhaust valves. Both of these famous 6's provide plenty of hard-pulling torque.

Six or V8, you'll go a long way before you see the likes of this '59 Chevy engine lineup. Actually, there's only one *best place* to go for all your trucking needs—and that's to your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

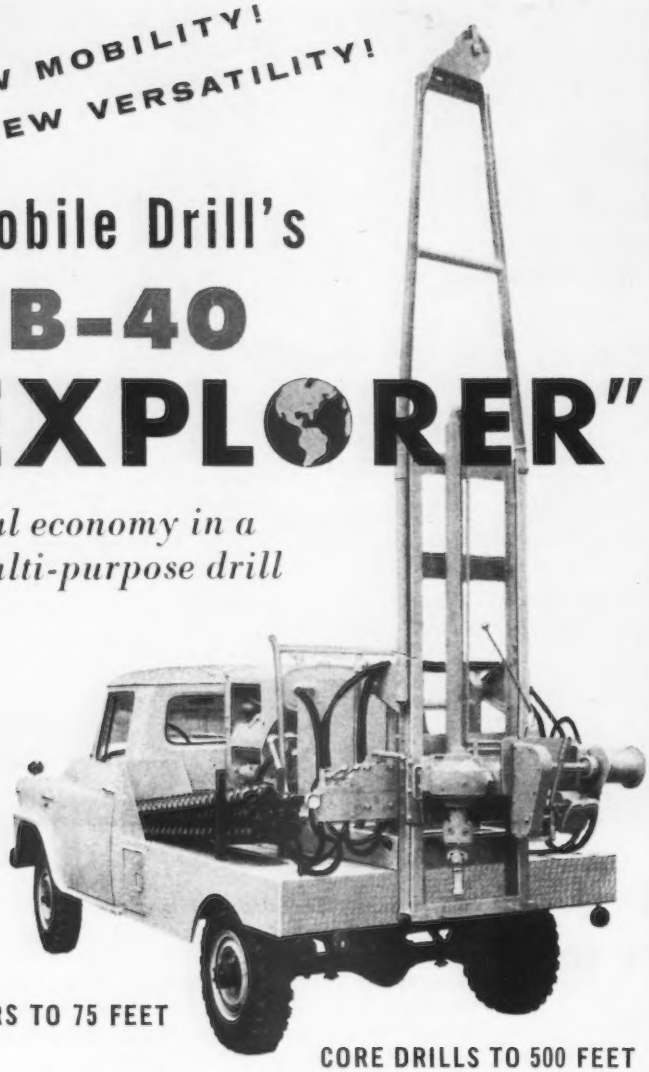
Chevrolet truck!

CHEVROLET

NEW MOBILITY!
NEW VERSATILITY!

Mobile Drill's
B-40
"EXPLORER"

real economy in a multi-purpose drill



AUGERS TO 75 FEET

CORE DRILLS TO 500 FEET

BORES HOLES UP TO 24" IN DIAMETER

- Mounting flexibility—compact B-40 fits any carrier ½ ton or heavier.
- Has independent power plant—4-cyl. 36-hp air cooled engine. Also available without engine for mounting on PTO-equipped vehicles.
- Powerful hydraulic cylinder delivers 68" stroke with ram pressure of 7069 lbs. up and 6283 lbs. down—exceptional power in a lightweight rotary drill.
- Hydraulic rotary head drive is geared for positive drilling action. Drilling speed range of 50 to 600 rpm for either coring or augering. Maximum torque: 1740 lbs.
- Controls to hydraulic cylinder, clutch and throttle are conveniently grouped for safe one-man operation.
- Hollow spindle drive features exclusive Mobile chuck for quick connection of drill stem. To change from core to auger drilling, merely remove drill stem, attach universal drive coupling and insert auger sections.
- No clearance problems—drill frame and tower lower to horizontal travelling position only inches above carrier cab.
- Drill is easy to dismount so that vehicle need not be tied up permanently as a drill carrier.

A Real Profit-Maker... Quickly Pays Off Its Low Initial Cost!

4-page folder gives details and specifications on the "Explorer." Write for your copy today.

MOBILE DRILLING, INC.
Dept. 33, 960 N. Pennsylvania St., Indianapolis 4, Indiana

George E. Gopher says:
"For a better return on your drilling investment, get Mobile Drill's B-40 Explorer"

Michigan *(Continued)*

During the 1958 season Pickands, Mather & Co. shipped 1,694,630 tons from the Gogebic range. The ore came from five mines: the Cary, Peterson, Newport, Geneva and Sunday Lake in that order with the Cary furnishing 416,788 tons. The Marquette range had but one PM & Co. operation: the Volunteer, 41,741 tons. The Menominee range had shipments from: the Buck group, 182,684 tons and the Fortune Lake, from stockpile, 2290 tons. The company's total from Michigan mines was 1,921,345 tons. The Newport, which made its first shipment in 1886, has made total shipments—through 1958—of 36,122,646 tons.

North Range Mining Co. produced 329,539 tons of Michigan ore in 1958. The Champion, on the Marquette range, was first with 123,973 tons: the Penokee, Gogebic range, had 103,178 tons and the Warner, Menominee range, 69,535 tons. The Book mine on the Menominee range, though closed, shipped 32,853 tons from stockpile.

MINNESOTA

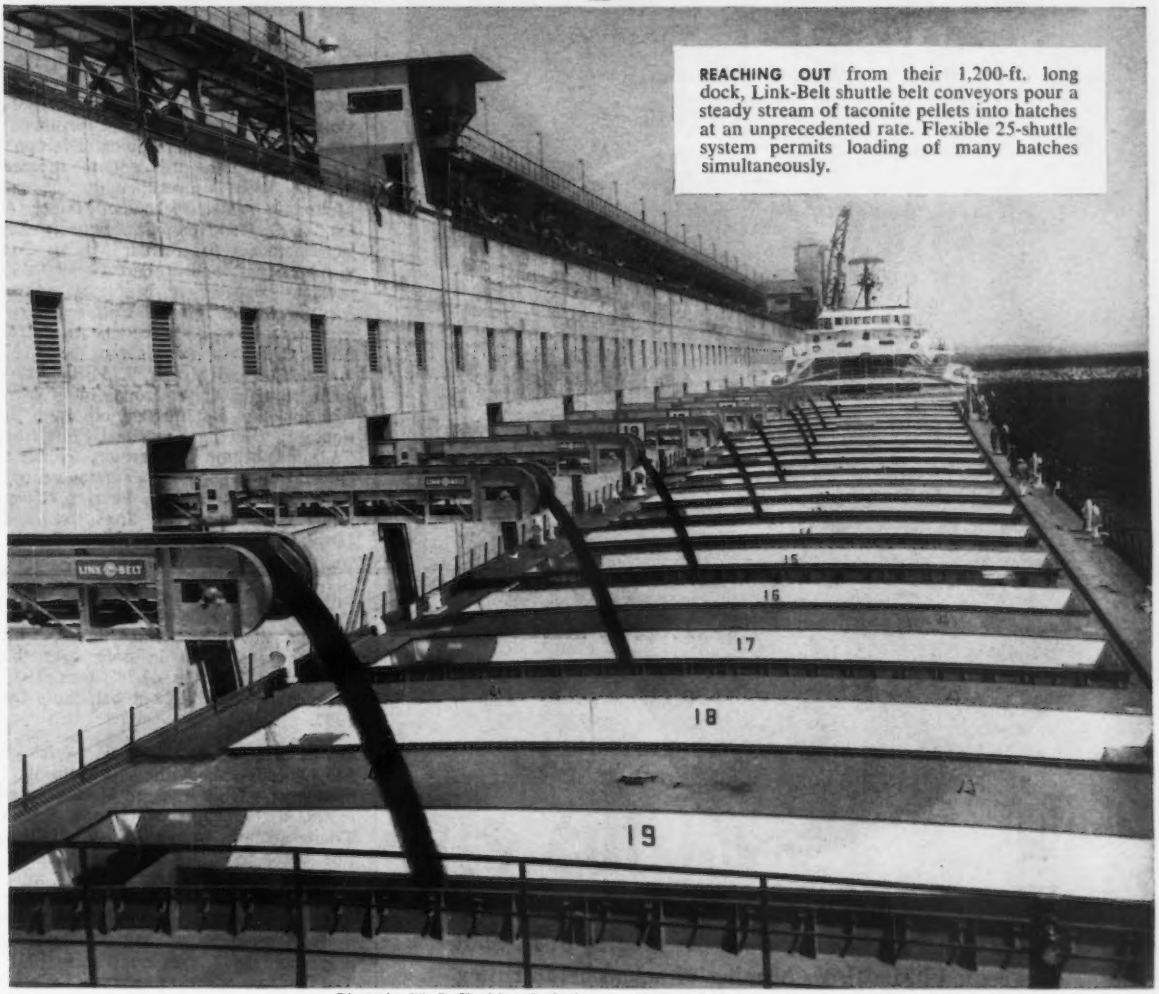
At M. A. Hanna Co.'s Roberts mine on the Cuyuna range stripping has been resumed. The Roberts was operated as part of the Kennedy mine by the Rogers, Brown Ore Co. from 1911-'23 and by Pickands, Mather & Co. for Rogers, Brown 1924-'25. The last shipment of 7800 tons was made in 1925 and total shipments have been 1,226,483 tons. The ultimate pit limits of the enlarged Roberts pit will include the old Kennedy underground mine and shaft, formerly considered as exhausted. The Kennedy was the first Cuyuna range mine to ship iron ore. Its last shipment was also made in 1925: 11,273 tons, with a total production of 1,369,079 tons. The Roberts reserve is presently listed as 1,238,700 tons.

Mine inspectors of St. Louis, Itasca, Crow Wing and Fillmore counties report that, for the first time in the history of iron ore mining in Minnesota, 1958 recorded no fatal or permanently disabling accident. A total labor force of 14,159 persons was involved.

M. A. Hanna Co. has recalled 180 men in the Hibbing district as reported by B. M. Andreas, manager of Minnesota mines for the company. 135 of them will return to the Morton mine and for stripping operations at the North Uno mine, and 45 to the Pierce mine tailings pond project.

Pickands, Mather & Co. has reopened three open pit mines in the Hibbing district: the Bennett at Keewatin, the Scranton at Hibbing and the Danube at Bovey. The Bennett was idle through most of 1958 and the Scranton and Danube were closed in October 1958. The Danube will carry on stripping operations until spring and the Scranton will do some drilling, blasting and rock hauling in preparation for the 1959 sea-

Push a button, pour a boatful



REACHING OUT from their 1,200-ft. long dock, Link-Belt shuttle belt conveyors pour a steady stream of taconite pellets into hatches at an unprecedented rate. Flexible 25-shuttle system permits loading of many hatches simultaneously.

Photo by W. R. Harkins, Duluth

25 LINK-BELT shuttle belt conveyors speed loading of taconite—cut turn-around time

WITH its Link-Belt shuttle belt conveyors, this new dock on Lake Superior approaches the ultimate in vessel loading speed and efficiency. Taconite pellets can be simultaneously weighed and loaded into two of the largest iron ore carriers with a precisely controlled flow. Each conveyor loads and trims at 750 or 1,500 gtph. And all feeding, conveying, advancing, retreating for one ship are *push-button* controlled by one man—even when "loading blind" in adverse weather.

This unique installation is typical of Link-Belt's ability to meet any materials handling need—large or small. For complete details, contact your nearest Link-Belt office. 15,021

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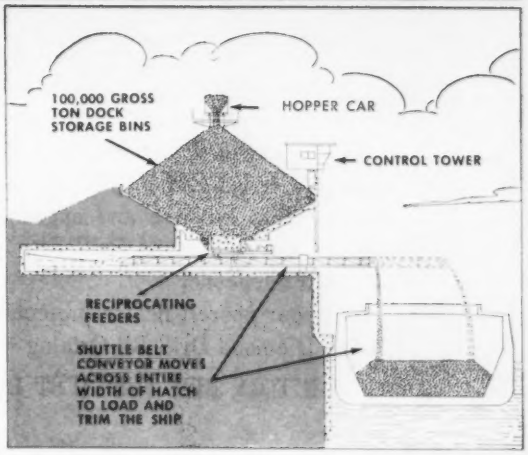
100,000 GROSS TON DOCK STORAGE BINS
HOPPER CAR
CONTROL TOWER
RECIPROCATING FEEDERS
SHUTTLE BELT CONVEYOR MOVES ACROSS ENTIRE WIDTH OF HATCH TO LOAD AND TRIM THE SHIP

CROSS SECTION OF DOCK shows flow of taconite from railroad cars to storage bins, then to reciprocating feeders and shuttle belt conveyors. Shuttling action of conveyors speeds and simplifies vessel trimming. Cars arrive daily from a processing plant of 7,500,000 ton annual capacity near the eastern end of Minnesota's Mesabi Range.

WE'VE SET OUR TEETH *for the job...*

Whether its coarse, fine grain, solid or broken formation EVERY diamond drill bit designed by J. K. Smit has behind it, hundreds of miles of actual field drilling tests.

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BIT BY BIT, THE BEST IS SMIT

SUPER MATERIAM IGNIS TRIUMPHANS

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
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Minnesota *(Continued)*

son. The Danube is expected to contribute heavily to PM&Co.'s 1959 shipping schedule.

The Engineers Club of Northern Minnesota held its annual meeting in Hibbing Dec. 10. Officers elected for the new year were: Marvin E. Johnson, Coleraine, assistant general superintendent in Oliver Iron Mining Division's Canisteo district, president to succeed W. D. Webb, superintendent at the Mahoning mine, Pickands, Mather & Co.; C. O. Rudstrom, Chisholm, general superintendent for Snyder Mining Co., vice-president, and Robert C. Wallace, assistant manager of Minnesota mines for the M. A. Hanna Co., secretary-treasurer. New directors chosen were: Edwin C. Johnson, Virginia, of the M. A. Hanna Co. and Morris V. Mielke, Virginia, with the Oliver Iron Mining Divison for the eastern district; John J. Foucault, Hibbing, Cleveland Cliffs Iron Co., and Milton R. Sermon, Hibbing, Oliver Iron Mining Div., for the central district; and Ronald B. Pearson, Coleraine, Cleveland Cliffs Iron Co., and Lloyd B. Hansen, Bovey, Oliver, for the western district.

The W. S. Moore Co. shipped 221,733 tons from four mines in 1958: the Mariska at Gilbert was highest with 158,882 tons. Next in order was the Norman at Virginia, 42,807 tons. 1958 shipments were about one half those for 1957.

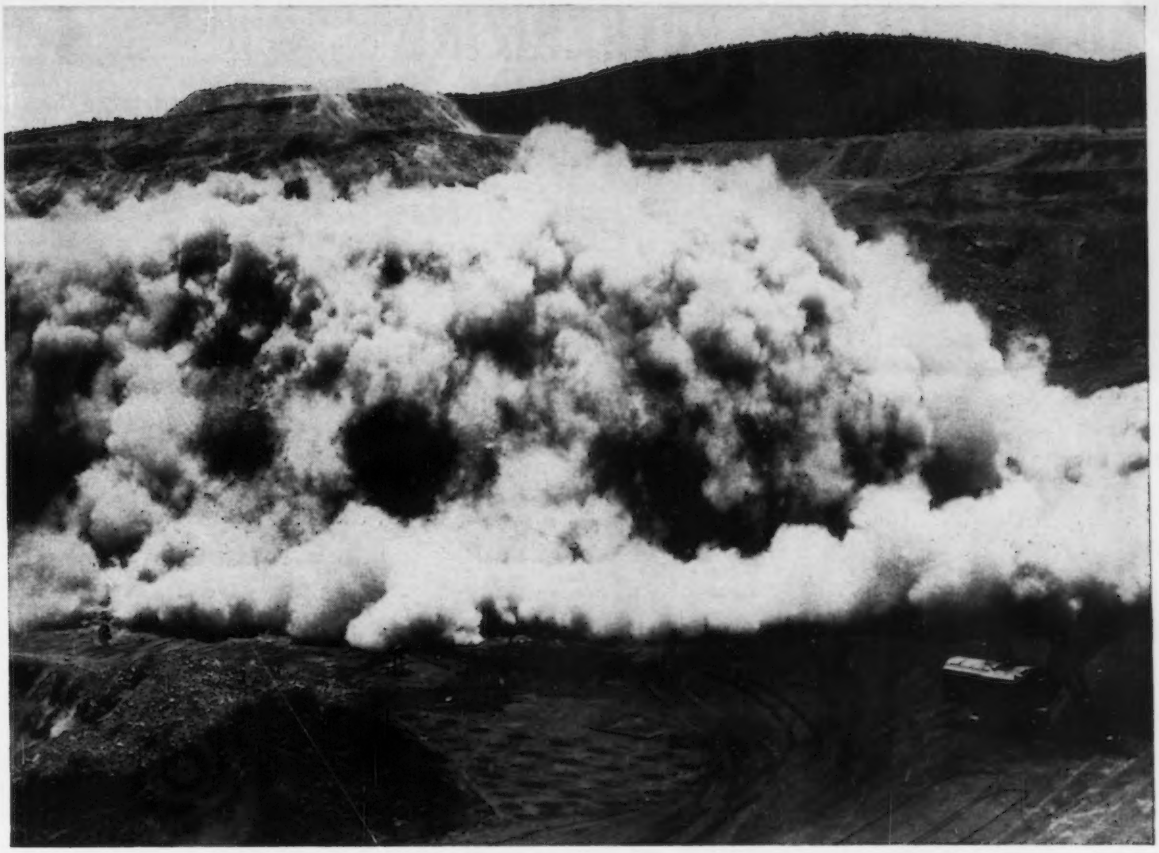
Snyder Mining Co. shipped a total of 545,428 tons—about one half of the 1957 production—from its three Mesabi range mines in 1958: the Webb and Sellers Triangle, the Godfrey and the Whiteside. Prior to 1951 the Sellers Triangle was included in Oliver's Sellers mine and operated by them. The Godfrey underground, taken over from the Oliver in 1957, produced 136,172 tons in 1958 only about 2,000 tons less than in 1957. The Godfrey operating territory includes one forty each of the Alexandria, Leonard and Monroe-Tenner mines.

The Haley-Young Mining Co. and E. A. Young, Inc. shipped 87,471 tons in 1958 from the Elbern, Grant and Minnewas mines, all on the Mesabi range.

M.A. Hanna Co. has continued stripping at its new Pierce mine in North Hibbing during the winter. The mine will probably load some direct shipping ore from the pit in 1959. Plans are being made for a large concentration plant to be built later.

Jessie H. Mining Co. shipped 121,902 tons from its Jessie mine near Grand Rapids in 1958. The company has bought the Smith Reserve, north-east from the Jessie, from Oliver Iron Mining Division. The property contains 496,500 tons of ore, has made no shipments.

During 1958 the Oliver Iron Mining Division put two new heavy media sections and two cyclone sections into service at its Trout Lake concentration plant at Coleraine, the oldest plant on the Mesabi range. It also built a new heavy



Blasting costs cut 68%

with USS Ammonium Nitrate

A prominent western company broke 23,000 cubic yards of waste limestone with only $648 worth of blasting material. They used 13,000 pounds of USS Ammonium Nitrate (fertilizer grade) mixed with diesel oil; 300 pounds of gelatin powder (60% dynamite); 65 electric blasting caps. To do the same job, this company had previously used $2025 worth of old-type blasting materials.

Here is how USS Ammonium Nitrate compared with the cost of other materials:

MATERIAL	COST PER 100 CUBIC YARDS OF LIMESTONE BROKEN
USS Ammonium Nitrate (compounded with diesel oil and 3% high explosive)	$ 2.80
Nitro carbo nitrate (compounded with 27% high explosive)	8.80
Ammonia dynamites	10.60

USS Ammonium Nitrate gives excellent fragmentation. It is economical, safe and easy to use. For more information on how USS Ammonium Nitrate can bring similar savings to your blasting operations, write to United States Steel, Coal Chemical Sales, 919 Kearns Building, Salt Lake City, Utah.

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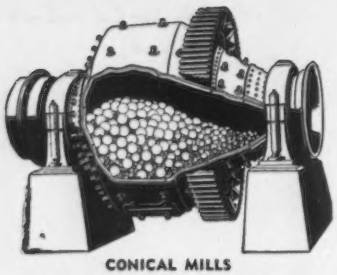
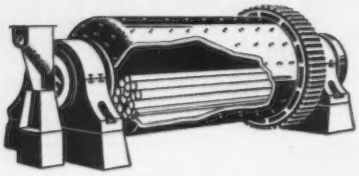
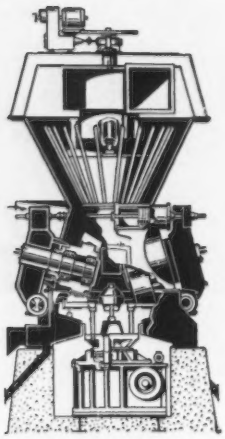
GRINDING AND PULVERIZING



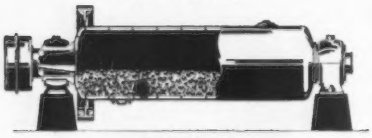
CONICAL MILLS



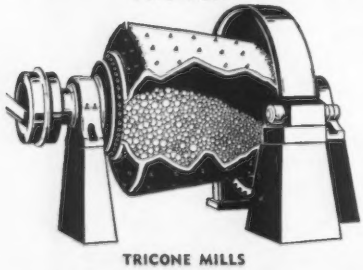
ROD MILLS



DISC-ROLL MILLS



TUBE MILLS



TRICONE MILLS

No matter what your grinding problem — coarse or fine grind — hard or soft material — Hardinge has a mill for the job. Check the applications of the different Hardinge Mills below:

CONICAL MILLS

The shape of the Hardinge Conical Mill causes a rapid circulating and classifying action within the drum, which increases the capacity for power expended over other types. The range of grinding is large, due to the segregation of the sizes within the mill. Size range from 2 feet to 10 feet with capacities from a few pounds per hour to 100 tons per hour. Bulletin 17-C-1 gives dry grinding applications; Bulletin AH-389-1 wet grinding.

ROD MILLS

Steel rods are employed as grinding media. Ideal for producing minimum oversize in open circuit grinding. Convex or conical heads reduce friction, prevent congestion of charge at the ends, and align the rods. Available with either end, or center, peripheral discharge, as well as trunnion overflow. Bulletin 25-C-1.

DISC-ROLL MILLS

An adaption of the German "Loesche Mill." A roller-mill with rotating grinding table and pneumatically-loaded rolls for complete flexibility of operation. The "Gyrotor" Classifier, combined with the Disc Roll Mill, provides a highly-efficient dry-grinding device, ideal for relatively soft minerals. Bulletin 52-1.

TUBE MILLS

For a fine product in open circuit without the use of classifiers. For mixing and grinding to secure a smooth texture or plastic product. Bulletin 18-A-1.

TRICONE MILLS

Built on the same principle as the Conical Mill, the Tricone Mill offers greater grinding volume for a given amount of floor space than any other tumbling mill built. Extremely efficient. Ideal for large tonnages. Sizes up to 12 ft. diameter. Bulletin AH-414-1.

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Minnesota *(Continued)*

media addition to its Hull-Rust plant at Hibbing, and began the work of doubling its screening plant at the Stephens mine in Aurora.

The Zenith underground mine at Ely the Vermilion range in 1958—its last year under Pickands, Mather & Co. management—shipped 170,046 tons. Including the 1958 season the Zenith has produced almost 20½ million tons and had an estimated 845,090 tons remaining at the end of 1958.

Pickands, Mather & Co. shipped a total 5,209,539 tons during 1958 from its Minnesota properties. More than one half of this total—2,694,482 tons—came from the Erie Mining Co. taconite plant at Hoyt Lakes. Erie is likely to maintain the leadership among PM & Co. shippers for many years. The Tioga No. 2, the company's most western mine on the Mesabi, was in second place: 674,-519 tons, and the old reliable Mahoning was third with 651,519 tons followed by the Embarrass, Scranton, Danube, Albany and West Hill. Picklands, Mather & Company's total shipments from Minnesota and Michigan were 7,513,767 tons as compared to 11,066,587 tons in 1957.

E. L. Joppa, Duluth, general manager of Pickands, Mather & Co., has announced that the Erie Mining Co. will begin this summer—scheduled for completion during 1960—construction of a $4-million addition to its Hoyt Lakes taconite plant. The new addition will house two experimental pelletizing furnaces for the purpose of conducting tests on the latest developments in pelletizing methods, Joppa explained. They are not designed directly to affect the production capacity of the plant which is rated at 7½-million tons annually. The addition will be built onto the present pelletizing building which contains 24 vertical shaft furnaces. The two new furnaces will be of this type. The plant has not yet reached full capacity, but is expected to ship about 6-million tons in 1959.

The 32nd annual meeting of the Minnesota Section of AIME was held in Duluth Jan. 12. A record number—649—attended the meeting, from 21 states and Canada. The nominating committee, Wm. R. VanSlyke, metallurgist with Cleveland-Cliffs Iron Co., chairman, presented its list of candidates for the coming year: Robert J. Linney, Silver Bay, executive vice-president of Reserve Mining Co., chairman; Kenneth E. Merklin, Hibbing, metallurgist, Pickands, Mather & Co., first vice chairman; Leon D. Keller, Virginia, district manager for Door-Oliver, Inc., second vice-chairman; John J. Foucault, Hibbing, manager Minnesota mines for Cleveland Cliffs Iron Co. third vice-chairman and Robert L. Bennett, Duluth, assistant manager of research for Oliver Iron Mining Division, renominated for secretary-treasurer. The slate was elected.

An unusual accident occurred at a Mesabi range taconite plant when a

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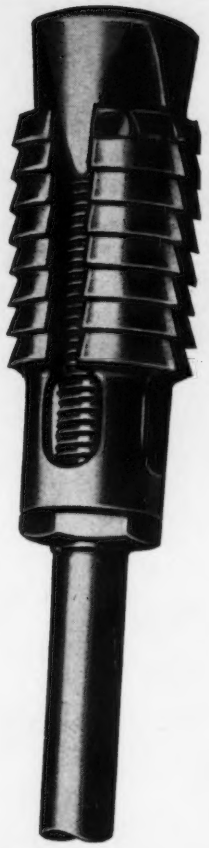
NEW!
Republic RS-1 Expansion Shell

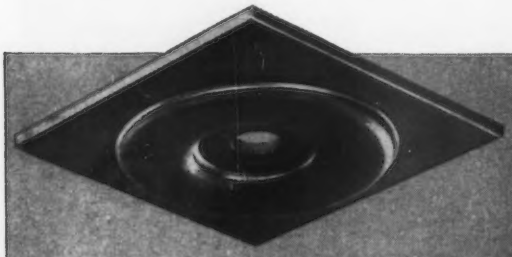
an all-purpose unit designed for effective use in any type strata



This new, improved, all-purpose Republic RS-1 Expansion Shell is designed with wide, sturdy leaves, and flaring inside taper for extra strength in relatively soft formations. The RS-1 anchor is particularly effective because the shell is held in position, before final tightening, by a new, Republic heavy-duty support nut. During the tightening process, the plug is drawn down into the flexible leaves, forcing them back into the rock in a wedge shape. Narrow base support for the leaves assures easy expansion during installation. The RS-1 is strong, flexible, and easily installed.

Republic offers the largest combination of roof bolts, roof plates, and expansion shell assemblies available to hold any type of mine roof or rock strata, safely and economically. Roof bolts of various types are now being used in hard rock metal mining, or in soft rock operations, such as gypsum and potash mining. They are also being used to provide support in tunnel work, miscellaneous foundation work, rock cuts, and similar projects.

Trained, experienced mine roof bolt engineers are always available for consultation at the mine. For more information on Republic's complete line of roof bolt assemblies, or for engineering assistance, contact your Republic representative, or mail the coupon.



Because of the embossed design, Republic's Do-Nut Roof Bolt Plate provides increased strength and greater area of pressure against the roof for maximum holding power, yet does not cause loss of headroom. Republic Roof Bolt Plates can be supplied in other types and sizes.

MATERIAL CONTROL CERTIFICATE FURNISHED BY REPUBLIC with every roof bolt shipment gives specific physical properties of the steel used. Guesswork and assumptions about performance are eliminated. Specific performance data for the heat, or heats, of steel used are indicated, including the mill order number, heat number, yield point in pounds per square inch, yield and break point in pounds for the size of the bolts.

MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

HEAT NO.	YIELD POINT (PSI)	YIELD POINT (POUNDS)	BREAK POINT (POUNDS)

The above figures are correct as contained in the official records of the Corporation.

BY _____
CHIEF METALLURGIST, BOLT AND CHAIN DIVISION

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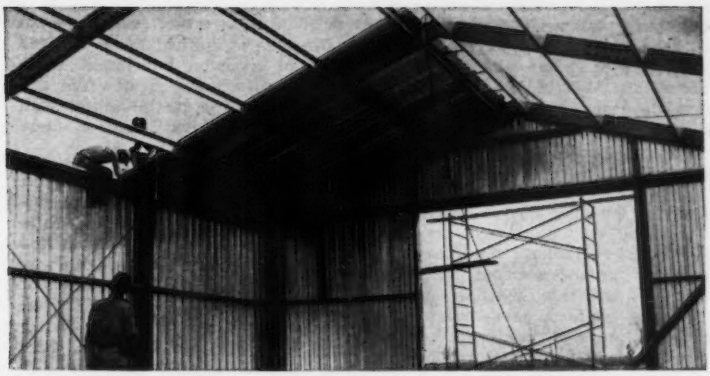

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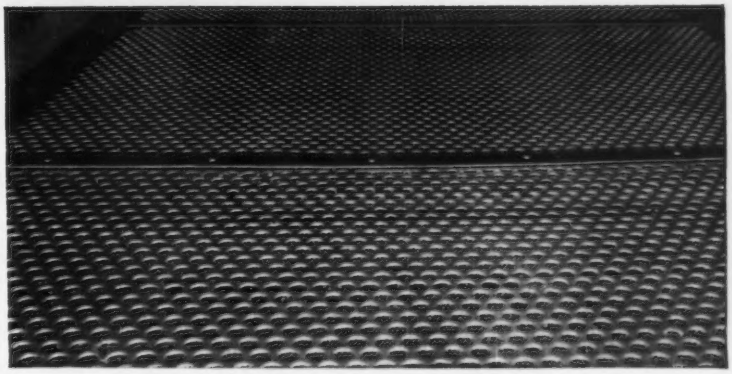
SUPERIOR STRENGTH PLUS CORROSION-RESISTANCE are two of the many features of Republic High Strength Steel which make it ideal for a wide variety of mine industry applications. In mine car and hopper car use, for example, these factors contribute to greatly reduced maintenance. Republic High Strength Steel also provides good impact and abrasion-resistance. It will pay you to evaluate all of these advantages in terms of your equipment performance specifications. For more information, mail coupon.

SUPERIOR PERFORMANCE OF REPUBLIC ENDURO® STAINLESS STEEL used for this cleaning plant shaker screen has drastically reduced replacement expense. Reason is ENDURO's excellent resistance to abrasion and corrosion. Other characteristics of ENDURO which pay service dividends in mine equipment applications include its good strength-to-weight ratio, easy cleanability, and high impact strength. In addition, ENDURO is readily formed and welded, simplifying both manufacturing and maintenance operations. Mail coupon for data.



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Minnesota *(Continued)*

worker's coat caught in a conveyor pulley and he was dragged into an ore bin. The injured man was not discovered for about four hours. He suffered fractures of the back, ribs and pelvis with some possible internal injuries.

MONTANA

Stepped up production in the Great Falls Reduction Department of the Anaconda Co. was announced by F. S. Weimer, manager of the department.

A sixth unit of the zinc operation was to resume Feb. 2.

The outlook for mining operations in Butte is good, providing costs can be controlled and kept in line with market prices for metals, Andrew R. Sims, general superintendent of mines for the Anaconda Co said in a recent talk.

"The ore is here and we will mine it as long as we can maintain a margin, on the profit side, between production costs and the selling price for our metals," he said. "Mounting costs coupled with lower prices have put heavy pressure on the nonferrous metals industry in general, and the challenge can be met only by improved methods and trimming expenses wherever possible."

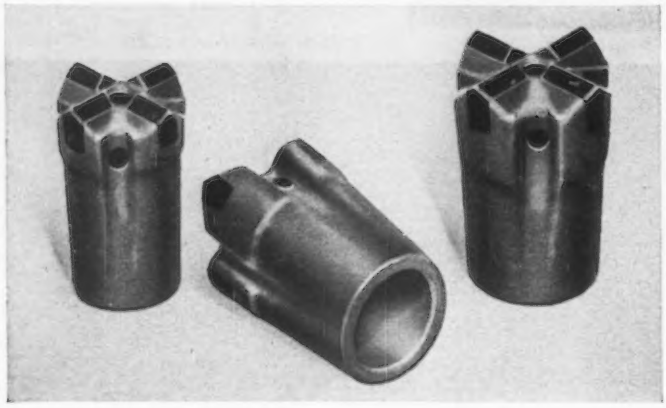
Mr. Sims said that some expansion plans for Butte mining operations, such as the Northwest project with its Ryan and Missoula shafts had to be deferred because of economic conditions. These have not been abandoned, however, and the company hopes to go ahead with them when conditions become more favorable.

Two field men are to be added to the staff of the joint mineral resources survey project being conducted in northwestern Montana by Pacific Power and Light company, Great Northern Railway company and the Montana Bureau of Mines and Geology. Willis M. Johns, field geologist in charge of the work, is mapping and analyzing field work done last summer.

BRUNNER & LAY

TAPER SOCKET

ROK-BITS



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NEVADA

Dodge Construction Co. during January shipped 5,000 tons of iron ore to Japan from its mine in Coal Canyon, Pershing County, and will make another shipment of the same amount in February. Despite rumors of a shutdown in the Japanese market due to contracts with Asian sources, Dodge has been assured of a new contract and is planning to continue operations indefinitely. Shipments are made by rail to Stockton, Calif., where the ore is loaded onto ships.

Southern Pacific Land Co., a subsidiary of Southern Pacific Railway Co., has completed 26,000 ft of drill holes in northeast Churchill County near the Pershing County line, and according to William McCullogh, chief geologist for the firm, the investigation has indicated a deposit of some 60-million tons of iron ore. An additional 40,000 ft of diamond drilling at a cost of $250,000 is planned. The ore deposits are on sections of land granted by the Federal Government to the railroad when it was first built in the 1860's. If expectations work out, Southern Pacific says it will build one of the West's largest beneficiation plants and a spur line to the site.

Nevada's mining industry is fast changing from metallics to non-metallics, according to Louis D. Gordon, executive secretary of the Nevada Mining Assn. In his annual review of the state's mining activities in 1958, Mr. Gordon said the non-metallics assuming an important place in Nevada's production are gypsum, diatomaceous earth, perlite, fluorspar, limestone, silica sand, barite, magnesite, sand and gravel, gem stones, talc, soapstone, lime, and marl.

Anaconda Copper Co. at the end of 1958 completed a full year without a single lost-time accident. A. E. Millar, manager of the plant and mine, said it is one of the most outstanding safety records ever achieved in the industry. A total of 438 men are employed at the Weed Heights operation which includes the Leviathan sulphur mine in the Sierra west of Hawthorne as well as the copper mine and mill near Yerington.

The first two truck loads of gold-silver ore from the Ohio mine in Goldpoint, Esmeralda county, averaged $46.50 per

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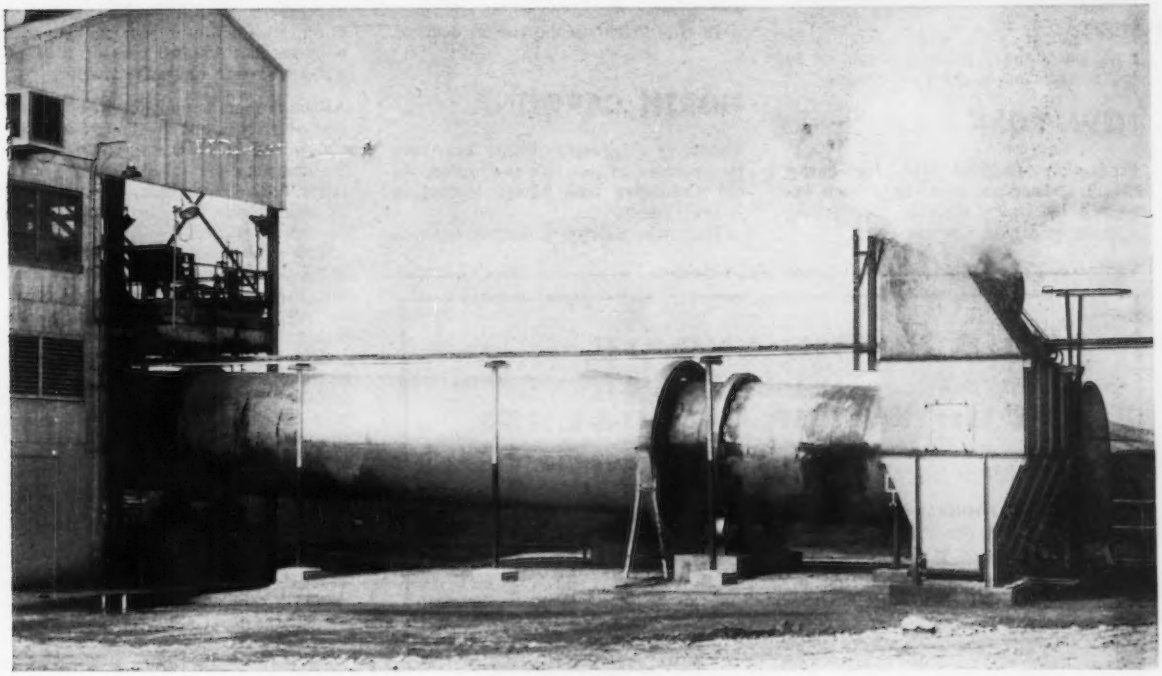

American Gilsonite's STANDARD cooler in operation at Grand Junction, Colorado.

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Standard Steel Corporation designed and built the rotary coke cooler now in operation at American Gilsonite's new refinery at Grand Junction, Colorado. This refinery, the first of its kind in the country to convert gilsonite into gasoline on a full scale commercial basis, uses an 8 ft. by 80 ft. coke cooler in the process. It's another cooler *Job-Engineered* by Standard Steel Corporation! A specially designed "floating inner jacket" protects the outer shell... and a water cooled feed and chute pre-cools the coke. Here is another fine name added to the long list of prominent, satisfied users of STANDARD STEEL rotary processing equipment.

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Nevada *(Continued)*

ton. The shipment was made early in January. Mining is being done under contract to Robert Milton and Harold Foss, both of Bishop, Calif., and ore is trucked 30 miles to the U. S. Milling & Minerals Co. mill at Silver Peak. Development work is continuing at a rapid pace, and a production rate of 80 tpd is expected in the near future.

NEW YORK

Production facilities for high-purity (ductile) vanadium metal have been expanded by Union Carbide Metals Co., division of Union Carbide Corp.

To meet an increasing demand—which began early this year—for this refractory metal, Union Carbide has tripled the facilities of its Fine Metals and Chemicals Department of Niagara Falls. Development of nuclear energy uses, a new supermagnetic alloy, and a new titanium-vanadium alloy reportedly have contributed to the rise in demand.

NORTH CAROLINA

Cranberry Magnetite Corp. has been incorporated to put into production the old Cranberry Iron Mines located in Avery County.

The step follows extensive research by Appalachian Exploration Co. during the past two years.

During the past summer 30,000 tons of material were removed from a waste dump at the old mine entrance and entrance and 3,000 tons of high grade magnetite were recovered. Based on this experiment, the company expects to recover 50,000 tons of magnetite and as a by-product 450,000 tons of road material from the old waste dumps.

Although there is no prospect of resumption of activities at the Tungsten Mining Co. mines in northern Vance County, the company has installed a larger and faster hoist at the mine, has increased its maintenance force and now is selling its inventory.

This was revealed in February by W. R. Atkins, an official of the firm, who said that by the end of February the inventory would be down to less than a month's production.

Atkins noted the price of tungsten on the domestic market was up 30% from the low of last fall which caused the mine to cease operations, but he emphasized that there is no prospect of immediate resumption of operations by a large force.

When operating at normal capacity, the mine employs between 400 and 500 persons, but only 15 are employed now for maintenance purposes. Should it be necessary to resume operations, some 60 days or more would be required to go on normal production, Atkins said.

SOUTH CAROLINA

Mining rights to 18 sites in Florida, North Carolina, South Carolina and Georgia have been purchased by Variety Products Mining Co., of Greenville. W. J. Bramlett, company president, said the deposits leased included titanium, feldspar, mica, manganese, copper, silver, gold, lead and zinc.

Bramlett said mica and asbestos deposits had been leased in South Carolina.

UTAH

Two men were charged Friday, Feb. 7, in complaints signed by U. S. Treasury agents in connection with theft of gold from the Utah Copper Division of Kennecott Copper Corp., Salt Lake City.

They were arraigned on separate charges of unlawfully acquiring gold without having a treasury department license.

Citizens holding or otherwise obtaining gold unlawfully in the United States are subject to ten years imprisonment or $10,000 fine, or both.

The complaints recite that the gold was taken a bit at a time from the process line at the Magna Mill. (It is believed that there are areas in the flotation cells where gold sometime tends to collect or separate out, in the process of flotation of copper ores. After passage of time, a "gold crust" is built up and it is believed that the thefts represent acquisition of this material.) Four one

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B-80M: only 9" diameter; 3" hose; 6 hp; 140 lbs; 300 GPM; max. head 115 ft.
B-150/200L: 6" or 8" hose; 65 hp; 1,200 lbs; 3,000 GPM; max. head 220 ft.

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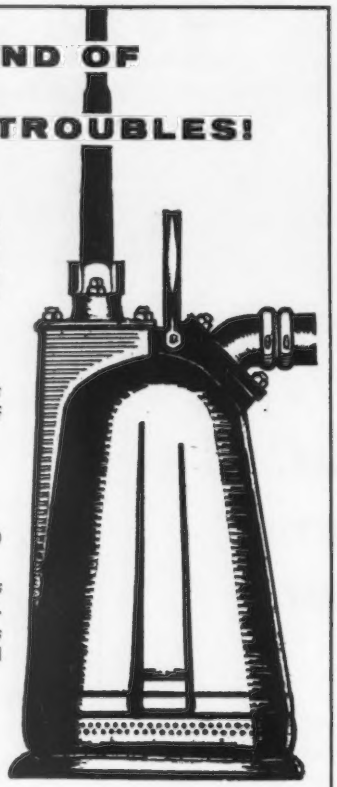

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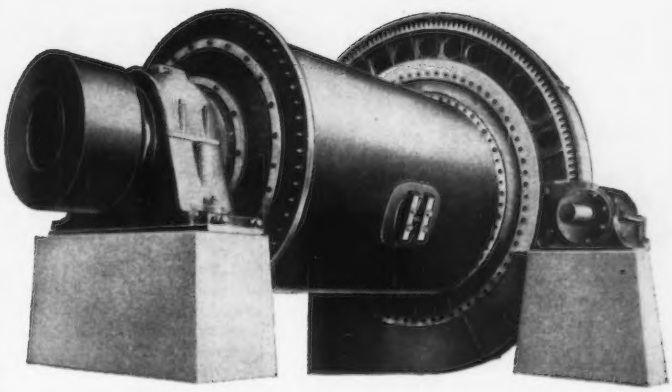

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Utah *(Continued)*

pound coffee cans full of the gold material were seized with arrest of the two men. The "T-Men" promised "additional arrests" in connection with gold thefts.

Rare Metals Corporation of America, an affiliate of El Paso Natural Gas Co., has started a core drilling exploratory search for copper in the Milford area of western Utah.

Letter sent by M. H. Kline, Salt Lake City, vice president of Rare Metals, to U-Beva Uranium Corp. said that Rare Metals had obtained assignment of the U-Beva mining lease from the Ogden Smelting & Refining Mills Co., Ogden. The lease covers the Sarault and other patented mining claims owned by U-Beva. There has been some prior exploration and development on the copper oxides ores, which lie close enough to the surface as to raise possibilities of open pit mining.

A $141,000 drilling campaign in San Juan County, has resulted in a "considerable lowering" of estimated uranium ore reserves of White Canyon Mining Co., the firm reported.

Texas-Zinc Minerals Corp., operating a mill at Mexican Hat, Utah, holds considerable stock interest in White Canyon.

Annual report of the mining firm by its president, F. J. Maloiot of Gilman, relates a net loss of $281,724 for the fiscal year ended Oct. 31, 1958.

He said that the company will mine out existing ore reserves in the White Canyon district "in the most efficient manner possible."

"Meanwhile, we have already staked out new areas which appear favorable for uranium production and we are continuing to take under option other likely leases for exploration," he said.

WASHINGTON

Work has been completed on the new inclined shaft at the Grandview mine near Metaline Falls it was announced by officials of American Zinc, Lead and Smelting Co.

John W. Currie, resident manager for the company, said the shaft is 500 ft long and it gains 150 ft of depth on the Grandview orebody.

A station is being cut on the new 650 level and an estimated 400 ft of tunneling will be required to get into the ore zone. The shaft was constructed at a point about 3,000 ft from the main operating shaft.

WYOMING

Federal Uranium Corp., Salt Lake City, has announced selection of Western Knapp Engineering Co., San Francisco, as prime contractor on its 522 tpd uranium mill in Wyoming's Gas Hills District.

The mill, to cost about $3-million, will use a form of resin-in-pulp process. Final details on the precise type of RIP have not been settled.

The contract, on which Western Knapp was low out of eight bidders, will not be signed until Atomic Energy Commission formally approves contracts between it and Federal on concentrates purchasing.

Associated with Federal in the project are Gas Hills Uranium and Radorock Resources, Inc., a Federal affiliate.

Western Knapp previously held the design contract with Federal on the mill.

Reynolds Mining Corp. has authorized expenditure of another $50,000 for experimental work at Lake DeSmet, where its parent company is considering locating a multi-million dollar aluminum plant.

IN CANADA

BRITISH COLUMBIA

Britannia Mining and Smelting Co. Ltd. has been liquidated and the mine has been reopened under the name of Howe Sound Co., Britannia Division. About 350 men will be employed for full scale operations, but at present 150 men, all ex-employees, are readying the No. 8 and Victoria mines for production and overhauling mine machinery.

Japanese interests have promised $1-million to help develop mining properties owned by O. G. MacDonald on Vancouver Island, president of Cowichan Copper Co. Ltd.

They are Nadira Mines, Avallin Mines, Caycuse Copper, Cellardor Mines and Tinitin Mines, all within a 30-mile radius of Cowichan.

MacDonald said that if any or all of the properties prove commercial, the developed ore could either be trucked to the existing mill at Cowichan or mills could be built at the mines proving to be the best producers. Capacity of the Cowichan mill which was built with the help of Japanese backing a year ago, could be raised to 1,000 tpd.

Alscope Explorations Ltd. has suspended operations at its copper prospect at Kentucky Lake, near Merritt. The company has increased its holdings in Vanex Minerals to 200,000 shares. Vanex is exploring a copper prospect in Merritt-Highland Valley area where an anomaly 2,000 ft long was indicated by magnetometer.

Showings of Bralorne Mines Ltd. are remaining strong and adding substantially to the company's principal ore source as each successive level of vein "77" is developed. Now drifting west from the point where it was intersected by the crosscut on the 35 level the vein has improved in grade and length from the 26 down.

An earlier drift, running east, opened 45 ft averaging 0.63 oz gold per ton across an average width of 5.7 ft. This work is 200 ft below the previous deepest level, the 33, which opened a length of 1,127 ft grading 0.99 oz gold per ton across an average width of 8.1 ft. A raise from the 35 up to the 34 and 33 levels is now being planned. A total of 99,475 oz of gold has been recovered out of 146,358 dry tons milled in the 12 months ending Dec. 31. In the fourth quarter of 1958 37,587 tons were milled and 28,113 oz of gold recovered.

ONTARIO

Kirkland Minerals Corporation is continuing underground development at its controlled Norstar Lake Mines in Davis Twp., some 25 miles east of Capreol. Drifting on the second level has reached the main zone which shows a width of 14 ft grading 0.50 oz gold per ton and 1.12% copper. On the first level the zone has been opened for 50 ft, which averaged 0.52 oz gold per ton and 1.95% copper. Drilling is continuing.

Siscoe Metals of Ontario chalked up another first in production from its Gowganda area silver operation last year. The mine, which has been in continuous operation for over 50 years, produced 1,267,393 oz of silver in 1958. The company is a wholly-owned subsidiary of Siscoe Mines.

Lowphos Ore Ltd, a subsidiary of M.A. Hanna Co. of Cleveland, Ohio, is reopening its Moose Mountain iron mine, some 35 miles north of Sudbury. Production is scheduled to start in April. Planned annual output is 550,000 tons of high grade concentrate. The treatment plant was completed in 1958 but operations were deferred at that time, pending improvement in market conditions.

Consolidated Denison Mines in 1958 marked up a production of $42,333,537 from its Elliot Lake area uranium mine. A total of 1,861,779 tons was milled for output of 4,239,761 lb of uranium oxide in the company's first full year of production. The first unit of the 6,000-tpd capacity mill was started in May 1957. Average daily tonnage in the past year was 5,101 tons, up from 2,676 tons in 1957. Present treatment rate is above 6,000 tpd.

Northspan Uranium Mines suspended production at the Spanish American, the smallest of its three uranium producing mines in the Elliot Lake area, early in February. The move was taken to bring the company's deliveries to the allowable rate under its contract. The Lacnor plant at 4,000 tpd and the Panel at 3,000 tpd are sufficient to maintain the permitted rate of deliveries.

Anaconda Iron Ore (Ontario), a Canadian operating syndicate of the U.S. Anaconda organization, has embarked on major development at its iron ore property north of Nakina. The company has exercised option on some 500 claims on which it has completed over 165,000 ft of diamond drilling. Work to date has outlined two separate orebodies, some two miles apart, containing an estimated 200-million tons of open pit ore in each.

Tires replace tracks for underground zinc-ore loading at Eagle-Picher mine

Production boosted 40%, repairs cut in half

In the sprawling, honeycombed caverns of a zinc mine 300 feet below ground, two rubber-tired Michigan Tractor Shovels are loading out 40% more ore than the crawler loaders they replaced—proving mobility is an asset anywhere—even below the earth's surface.

Owner Eagle-Picher Company's switch to Michigans here at Galena (Ill.) has produced a number of important advantages. First, they eliminated an hour of waste time every day. "It used to take crawlers 20 minutes just to creep a mile or so from our central service area to the work sites," explains Mine Supt. Ed Huoy, "and 20 minutes at the end of the day to come back again." The Model 175A Michigans make the trip, either way, in five minutes.

Triple output on scattered loading

"Also, in certain areas of the mine where loaders must carry shot rock as much as 100 ft to truckload, the rubber-shod machines often do three times the work of crawlers," Mr. Huoy continues. "The same advantage holds true when loads must be taken in succession from different headings in order to get the desired 3% blend of zinc for processing."

One Michigan keeps five trucks busy

Michigan output is high on straight loading too, according to General Supt. Harold Haman. "With trucks on average one-way haul distance to the crusher of about one mile," he says, "one Michigan loads out as much as 100 tons per hour. It alone keeps five 8-ton trucks busy. Each 8 ton load takes a Michigan three passes, two to four minutes. A typical day yields 1,400 tons of rock. Previously, with crawler loading, our top output was 1,000 tons. The daily increase, 40%."

Maintenance costs 50% lower

According to Robert Haffner, manager of Eagle-Picher's Illinois-Wisconsin operations, "Michigans not only load out more rock than the crawlers, but their cost of maintenance per ton loaded *is about half*. Shot rock, so rough that tracks and track frames required numerous overhauls, have been comparatively easy on tires. Re-capping is needed only every 1,000 hours or so.

"Before Eagle-Picher settled on Michigans, we tried other machines," continues Mr. Haffner. "After careful consideration, we decided Michigans had the sturdiness, mobility, and productive capacity we needed. We now do all loading here in Galena—and at our Shullsburg (Wis) mine—with Michigans. Four of them. So you can see how much we like them!"

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QUEBEC

A preliminary ore estimate has been prepared from results of diamond drilling on the New Hosco Mines property in the Mattagami district. Dr. R. B. Graham, consulting geologist, gives an estimate of 1.6-million tons averaging 2.53% copper, plus a possible 168,800 tons grading 2.17% copper and a further 716,000 tons averaging 8.23% zinc. It has been recommended that plans be prepared for underground exploration and development. Present thinking is along the line of an 800-tpd operation.

Diamond drilling on Chesbar Chibougamau Mines' iron prospect near Lake Waswanipi has indicated a deposit estimated to contain over 20-million tons grading 29.9% iron. The estimate covers a partially explored area, 3100 ft long, 125 ft wide, and 500 ft deep. Drilling to further delineate the deposit is in progress. The company is also drilling on an adjoining 35-claim optioned group on which an anomaly, about 1800 ft long and from 200 to 600 ft wide, has been outlined.

Several survey parties are engaged in geophysical surveying on the large holdings of the Gabbro Syndicate in the Frotet Lake district, some 50-60 miles north of Chibougamau. The syndicate has acquired 363 claims in seven groups on the results of aerial geophysical surveys over a 350-square mile area.

Stadacona Mines has ceased operations at its gold mine in the Noranda area. The mine started production in November 1936. The decision to close was prompted by increased production costs coupled with no immediate prospect of improved ore grade, nor higher gold price or amount of cost-aid. The company is selling its equipment, machinery and plants on the property.

Surface exploration is currently in progress on the Chibougamau Asbestos property at Chibougamau Lake. Work is to include a magnetometer survey of unexplored sections of the property located on the mainland. Surface work and diamond drilling on the island claims in 1956-57 indicated over 9.5-million tons of asbestos bearing rock to depth of 400 ft in two zones plus a third zone which was only partially explored.

A new staking rush has developed to the west of the Mattagami Lake district near Turgeon River. The new activity straddles the Ontario-Quebec boundary. The largest entrant on the scene is the Kesagami Syndicate, composed of the same six companies which launched the Mattagami Syndicate. These are: Area Mines, Dome Mines, Highland-Bell, Leitch Gold, Teck-Hughes Gold and Iso Uranium. The syndicate has outlined several strong anomalies scattered over some 1,350 claims staked.

Portage Island (Chibougamau) Mines is planning to go underground at its copper prospect in the Chibougamau area. Present plans call for the sinking of a shaft to initial depth of 600 ft.

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ALBERTA

Mineral production in Alberta on the basis of preliminary figures showed a substantial 17.4% decline in value during 1958 as compared with 1957.

Compiled by the Dominion Bureau of Statistics, the statistics were contained in an annual review of business conditions prepared by the Alberta Bureau of Statistics, Department of Industries and Labor.

Most of the slump recorded for 1958 traced to curtailment of crude oil shipments from the province. It was pointed out that despite higher production for nearly all minerals during 1958 as compared with 1957, total unit prices showed a decline.

IN LATIN AMERICA

CHILE

First shipments are expected in February or March from a newly founded Canadian group. Andacollo Mining has taken over the operations of the Andacollo Mine in Chile through purchase of Cia. Minera San Felipe.

The mine is located near San Felipe and its ore is being custom processed and upgraded to 50% Cu and some gold and silver values.

Howard Steven Strouth, founder and for four years president and general manager of Stanleigh Uranium Mines is president.

Correction

IN THE PAST several months, *E&MJ* has made reference to Cia. Minera Santa Fe's deposits in Chile and in particular to El Laco. Statements that Cia. Minera Santa Fe was owned by Isbrandtsen Co. Inc. are in error. It is in no way connected with Minera Santa Fe, other than the fact that Mr. Isbrandtsen, head of the steamship company, also owns a part interest in Minera Santa Fe. There is no agreement between Bethlehem Steel and Minera Santa Fe for any of the iron from El Laco. There are agreements in connection with other orebodies in Chile, but not at El Laco.

Cia. Minera Tamaya in its Los Mantos mine at Punitaqui, Coquimbo Province, has been producing for close to two years 11 tons of metallic mercury per month from a new ore shoot found about two years ago near the bottom of the mine. The high grade ore, (about 10% Hg) is retorted straight, but the low grade, (0.75%) is concentrated by flotation to 25-50% Hg depending on grade and the relative proportions of cinnabar and tetrahedrite in the ore. Some metallic mercury and chaucite are also found in the ore shoot. As this vein also contains copper and gold, the concentrate, after retorting, runs 15% Cu and 3-½ oz gold per ton.

Another active mine in this famous old mining camp is Delirio mine and its mill which produce between 300 and 400 tons of 28% copper concentrate per month.

ARGENTINA

The German Friedrich Krupp enterprises of Essen have expressed interest in developing the Sierra Grande iron ore deposits in the southern Argentine province of Rio Negro, according to reports from government sources.

Dr. Elpidio Lasarte, representative of the Argentine Industrial Bank, recently left for Europe to negotiate with Krupp representatives in connection with this project.

Exploratory works carried out by the Argentine Military Factories revealed the existence of at least 100-million tons of iron ore in the Sierra Grande.

Mining experts—including those of the National Lead Co. which is also interested in the project—who visited the zone between Puerto Madrya and San Antonio Oeste believe that the exploitation of both surface and underground deposits will prove to be profitable. The composition of the ore is given as 55.6% iron, 6.9% silica, 13% phosphorus, and 0.4% sulphur.

URUGUAY

Uruguayan authorities are optimistic concerning recent findings of large manganese and iron ore deposits in the zone of Zapucay, 250 miles north of Montevideo. Government would like to export $250-million worth of ore annually to Germany, or a total of $500-million worth to the European Common Market's Montan-Union.

According to reports the recently found Zapucay ore is an ideal mixture for processing in metallurgical industries. Plans are already being drafted to construct a railroad line into the area, linking the town of Rivera to the seaport city Fray Bentos, and to start large-scale dredging of the Fray Bentos port to make it operable for big freighters which would carry the ore to Europe.

IN AUSTRALIA

The rise in Australian domestic prices of zinc and lead metal will assist EZ Industries Ltd. and the Broken Hill lead-zinc producers but Mt. Isa Mines Ltd. and companies which don't use local refining facilities will fail to benefit.

The voluntary 10% reduction in working time caused production of Zinc Corp. Ltd. and New Broken Hill Consolidated Ltd. to fall sharply in 1958. Zinc Corp.'s tonnage of ore treated fell from 767,069 to 659,268 and lead concentrate production was 107,732 against previous 122,820. Zinc concentrate output dropped from 139,684 to 115,347 tons. New Broken Hill milled 527,122 (721,241) tons of ore and its output of zinc concentrate dropped from 154,325 tons to 119,103 tons while lead concentrate production was 77,400 (87,975) tons.

Increased grade of ore offset the reduced tonnage treated by Broken Hill South Ltd. in the six months ending Dec. 31. Crude ore treated dropped from 185,670 to 166,760 tons. Lead assay moved up from 11.8% to 12.5%, zinc from 11.4% to 12.2% and silver from 7 oz. to 7.4 oz.

Output of zinc at the Risdon works of Electrolytic Zinc Co. of Australasia Ltd. for six months ending Dec. 31 moved up from 56,755 tons to 64,437 tons. At the West Coast plant, the output of lead concentrate moved up from 5,223 to 5,945 tons and of zinc concentrate from 33,526 to 35,069 tons.

Mt. Isa Mines Ltd. is well on the way to a record ore treatment of more than 2-million tons in its fiscal year 1958-59. Last year's throughput was 1,655,070 tons. The big expansion program is now taking place. In the first seven 28-day periods a total of 1,138,498 tons of ore were treated as against previous 810,104 tons and in the latest 28-day period production was up to 163,216 tons despite Christmas holidays. Figures for the latest period included lead ore treated 68,778 tons, lead produced 4,700 tons, zinc concentrates 1,789 tons, copper ore treated 94,438 tons and copper produced 2,840 tons.

IN THE PHILIPPINES

The price of gold in the Manila free market has advanced to 136 pesos an oz. Sales for blocked peso accounts are reported at 140 pesos. Theoretically this would indicate $70 an oz, if the statutory ratio of two for one prevailed, but pesos are currently selling at three for one in the open market.

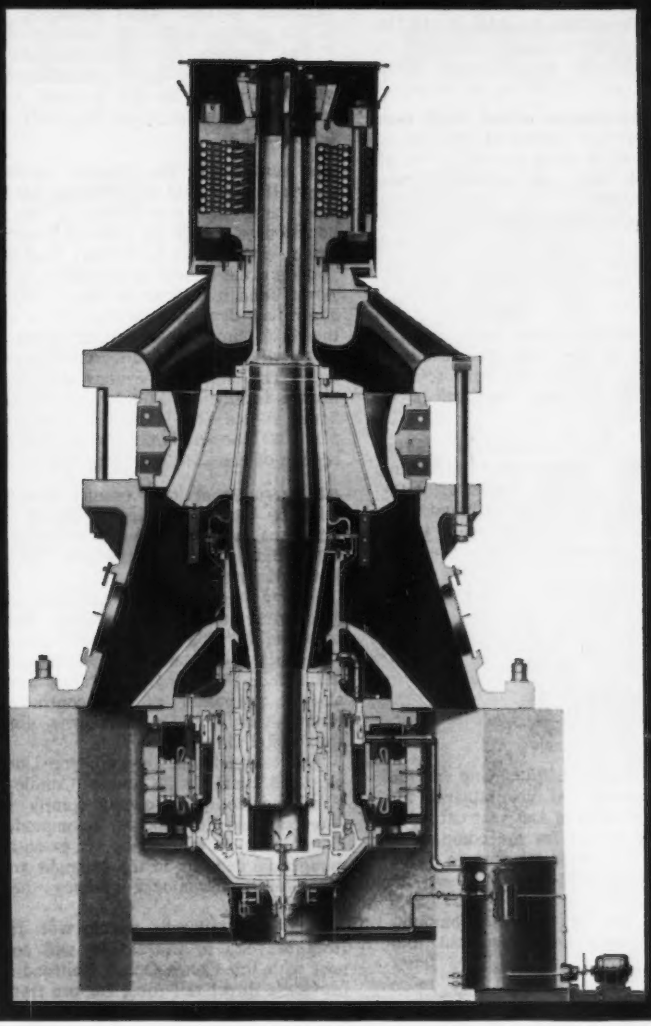
Atlas Consolidated milled 356,654 tons at its Toledo mill in December, averaging 0.65% copper. Concentrates produced are estimated to contain 4,168,658 lb of copper and 934 oz gold. This represents the highest copper recovery for 1958. Output represents 30 milling days.

Shipments of iron ore concentrates to Japan were valued at nearly $1.5-million. Including shipments of 16,300 tons from Mati, the total value of all shipments in December for the company was $1,660,000.

At the Mati iron mine six deposits are being prepared for mining. Three are open pit, the others underground. The mine is equipped to deliver 20,000 tons a month of combined direct shipping and milling grade ore. The mill is presently operating on 300 tpd, to be increased to 500 tons. Ore reserves are

2-WAY TRAMP IRON PROTECTION

Exclusive with the KENNEDY Gearless Reduction Crusher



Ordinary tramp iron and uncrushable oversize is passed by the quick-acting, positive spring cage, without damage.

The KENNEDY patented built-in drive coupling with its overload device, provides positive protection against breakage from unusually large pieces of tramp iron. Operates only when uncrushable material enters crusher.

Uncrushable material inevitably finds its way into every reduction crusher. Only with the KENNEDY Gearless Reduction Crusher is absolute protection assured—for only KENNEDY provides 2-way protection against costly machine damage.

Write today for your copy of Bulletin No. 58-D describing the many other important features of the KENNEDY *Gearless Reduction Crusher.*

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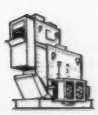
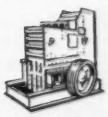
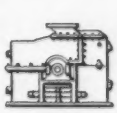
Primary Gyratory


Cuber Senior

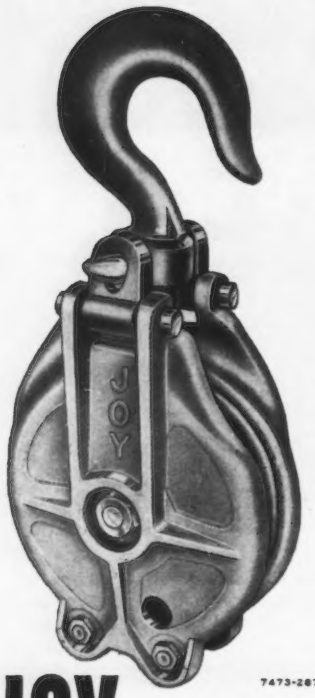

Cuber Junior


Hammer Mill

Roll Crusher

Overhead Crusher

Swing Jaw Crusher



7473-267

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forged construction

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There are no pins, chains, bolts or nuts to handle or remove. TO OPEN JUST TURN AND PUSH . . . no parts leave the block to become lost. The rugged opening mechanism will last for the life of the block.

Write for Bulletin

JOY

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Philippines *(Continued)*

unchanged. It is planned to maintain production of 15,000 to 20,000 tons per month in 1959 of combined lump and concentrates. The mill flowsheet consists of crushing, grinding, and magnetic separation with flotation of the magnetic tails to recover copper.

Lepanto Consolidated shipped 10,230 metric tons to Tacoma, estimated to contain 5,693,000 lb of copper, 9352 oz of gold, and 38,124 oz of silver.

Surigao Consolidated milled 9,222 tons in December and recovered 2804 oz of gold, 3192 oz of silver and 86,350 lb of lead. Total value of production was about $213,000.

A further tonnage increase was made in January, from the Siana, Mainit and Surigao properties. Tonnage milled was 9,566, with gold recovered at 2,030 oz, silver 2,640 oz, and lead at 88,830 lb.

Shipments of refractory grade chrome ore were up in December from Consolidated Mines, with 49,550 tons sent to the U.S. The shipment was valued at over $970,000.

Charles A. Mitke, president of Manila Mining Corp. reports that important copper veins have been found on company holdings at Agusan, Mindanao. Eleven trenches have been cut at intervals across the vein, which appears to be about 16 ft wide, showing solid chalcopyrite interspersed with low grade material.

IN AFRICA

Except for copper, chrome and tin the Union's production of base minerals for the first 11 months of last year exceeded in value the output for the comparable period of 1957. Asbestos rose in value to £8,628,209 ($24,159,000)—an increase of about £207,000 ($579,600)—and iron ore by a similar amount. Coal, manganese and prescribed materials all showed a gain, the latter being £2,700,000 ($7,560,000) more in value than the figure for January-November 1957.

The mineral output of Tanganyika increased last year against the 1957 performance. Diamonds were up in the first 11 months of the year by about 112,000 carats; the gold output increased by nearly 2,000 oz (51,091 oz against 49,387 oz the previous year), and lead and tin also showed a rise. Only silver was down to any substantial degree: 16,828 oz compared with 18,880 oz in 1957. The value of all metals increased last year nearly £1,000,000 ($2.8-million)—an improvement of approximately 25% on the previous year.

For the first time since the Merriespruit mine was flooded about two years back there is likely to be development on reef in the property this quarter. Merriespruit is one of the Anglo-Transvaal group in the Orange Free State.

The 28-level haulage tunnel being driven from the adjoining Virginia for dewatering purposes has penetrated 3,379 ft and its companion 2,805 ft into the Merriespruit area and is approaching the Basal Reef horizon.

Meanwhile boreholes are being drilled upwards from the haulage and 22 have intersected the reef. Of these, 14 have indicated payable values averaging 375 in.dwt and 19 in.-lb.

The haulage itself now appears to have about 5,800 ft. to go to reach a vicinity adjacent to No. 1. shaft from which the dewatering of the shaft can be tackled.

The headgear of the Margaret shaft at the Stilfontein gold mine in the Klerksdorp area has been modified to accommodate a 4300 hp four-rope friction drum winder. This is the first four-rope friction drum winder to operate in South Africa and the first to have rectifier controlled dynamic braking. It is also the first automatic ac rock winder to be installed on a South African gold mine. The electrical portions were engineered locally by Metropolitan-Vickers South Africa (Pty.) Limited, who supplied all the equipment with the exception of the grids and rotor contactors.

An international joint venture co-sponsored by Utah Construction Co. of San Francisco has been named to build a $26-million jungle railroad in French Equatorial Africa.

Joining with Utah Construction Co. to construct nearly 200 miles of single track railway for the transportation of manganese ore will be Compagnie Industrielle de Travaux (Citra) of Paris, also a co-sponsor of the contracting venture, and Taylor Woodrow Construction, Ltd. of London.

The railroad will be built for Compagnie Miniere de L'Ogooue (Comilog), a mining company owned jointly by American and European steel companies. Comilog is now developing extensive manganese deposits in the Moanda area of French Equatorial Africa near Franceville.

The new railroad, which will run from Mayoko to Brazzaville, will connect with the Congo-Ocean Railroad to provide a direct rail route for ore transportation from the mine to the seaport of Pointe Noire. With its route lying through heavy jungle, the project involves extensive clearing operations and earth moving totaling nearly 10,000,000 cubic yd. Two major bridges and 30 smaller crossings will be constructed.

The project will be completed in about three years.

IN EUROPE

ITALY

The Sicilian Region has set up a $2-million fund for mineral prospecting on the island in 1959.

Of this amount, $1.15-million will be assigned to sulphur prospecting, $640,000

27 ton

"EUC" REAR-DUMP

It's new...but JOB PROVED!

325 or 335 h.p. . . . Torqmatic Drive . . . 18.00 x 25 tires

Model R-27 is a new size in the complete line of Euclid Rear-Dumps—rated payload is 54,000 lbs. This off-highway hauler incorporates the job-proved components which have made Euclid Rear-Dumps the outstanding choice of contractors, mines and quarries.

With either 325 h.p. GM diesel or 335 Cummins engine, Allison Torqmatic Drive makes maximum use of the power for faster hauling cycles. Converter lock-up in the 4-speed Torqmatic permits 34 mph speed with full payload and efficient performance on long, high speed hauls.

Standard 18.00 x 25 tires on all four wheels assure the traction and load carrying capacity needed for moving 27-ton payloads on tough hauls. Standard body is rated at 18 cu. yds. struck —quarry type body is also available. The R-27 is equipped with oil retarder for safer, more economical braking on jobs with steep down-grades on the loaded haul.

See your Euclid dealer for detailed specifications on this new 27-ton Rear-Dump . . . it's a good example of the advanced design that makes Euclid your best equipment investment.

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A complete line of Rear-Dumps—10, 15, 18, 22, 27, 40 and 50 ton capacities, also semi-trailer models of 12, 22 and 35 ton payload—to fit any job.

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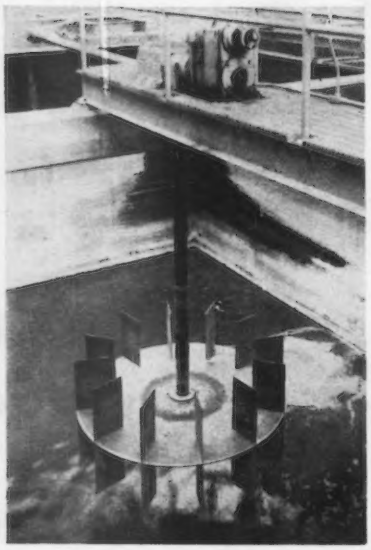
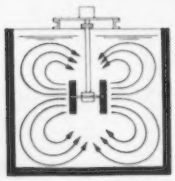
EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

CONSIDER THE ADVANTAGES OF INFILCO *Balanced* MIXER DESIGN



Maximum mixing per horsepower input — minimum maintenance



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mixers for rapid mix
VORTI-FLOC®
units for slow mix
VORTI-MIX®
dispersers for gas absorption

Speed alone will not insure complete mixing—unnecessary speed wastes power. Power requirements vary directly as the quantity of liquid pumped and as the cube of the mixer speed.

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The "VORTI-FLOC" unit accomplishes self-coagulation. The gentle flow and turbulence in the liquid creates repeated particle contact which results in particle growth. No underwater bearings are necessary in the "VORTI" and "VORTI-FLOC" units, except in unusually deep tanks.

The "VORTI-MIX" gas disperser effects high rates of gas absorption in liquids. Oxygen absorption from air can be obtained with efficiencies of 25% and higher.

It will pay you to investigate the advantages of these balanced design mixers. Write today for Bulletin 730-5430.

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Italy *(Continued)*

to radioactive minerals, and the remainder to metal minerals and phosphates.

Gordon I. Gould & Company, of San Francisco, Calif., ore furnace designers has announced appointment of Saima, Speciali Apparecchiature Industriali Meccaniche ed Affini, Milan, Italy, as agents for mercury ore treatment equipment in Italy. Saima has worked in the iron ore, sulphur, mercury, lead and other metal and nonmetallic fields in Italy.

During the first eleven months of 1958, Italy exported 30,525 metric tons of sulphur ore for a value of $1.115-million compared to 120,813 tons and $5-million for the same period of 1957.

POLAND

The first metric ton of Polish sulphur was mined and delivered to the processing plant during December's second half, according to a Warsaw daily.

The sulphur, mined in Ogorzelec, was shipped to the "Ubocz" phosphorus fertilizer factory of Lower Silesia. Daily flow to the processing center is to reach 40 metric tons. The quality of the Polish-mined sulphur is claimed to be equal to the imported material, originating in the Chinese Peoples Republic.

An experimental concentration station has been set up at the mining site, but only little pure sulphur has been derived so far. The first rectifying stations are now under construction there, scheduled to yield the first 100 metric tons of pure sulphur during the first quarter of 1960. The annual yield is to increase to 1,000 metric tons in 1960.

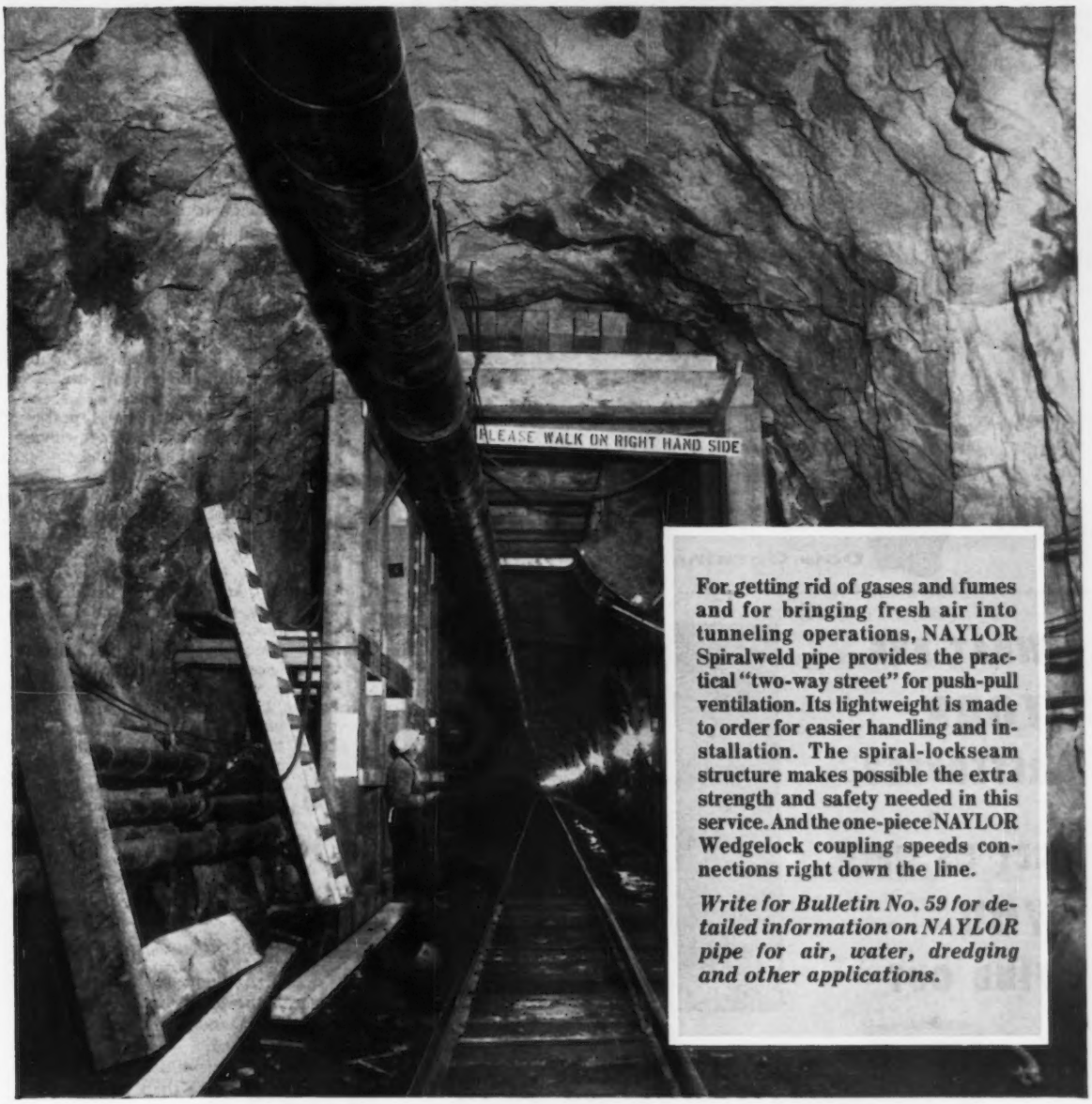
BULGARIA

Bulgaria plans to produce 12,600 metric tons of electrolytic copper by 1962, when a newly-commissioned plant achieves its ultimate output. Aside from the copper, the plant will yield copper sulphate and sulphuric acid. Also, the plant is expected to produce—as the only plant in the Balkans—selenium, gold and silver.

AUSTRIA

Increases were reported for 1958 for copper ore, where the 1957 yield was slightly exceeded by 1958's 166,000 metric tons. A 5,000 metric tons increase was reported in 1958 for the lead-zinc ore production, which reached almost 188,000 metric tons. A 12% increase in output of bauxite brought the 1958 level to 25,000 metric tons. Crude magnesite increased by 4% and exceeded 1.2-million metric tons. Graphite output reached 21,000 metric tons in 1958, the 12% increase over 1957 based on higher 1958 exports.

TWO-WAY STREET
For Ventilation



For getting rid of gases and fumes and for bringing fresh air into tunneling operations, NAYLOR Spiralweld pipe provides the practical "two-way street" for push-pull ventilation. Its lightweight is made to order for easier handling and installation. The spiral-lockseam structure makes possible the extra strength and safety needed in this service. And the one-piece NAYLOR Wedgelock coupling speeds connections right down the line.

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Use this grease-like silicone dielectric as a sealing agent in cable connectors and disconnect switches to prevent shorts and arcs. A light coating keeps lamp bulb bases, fuse cartridge clips and battery terminals corrosion-free. 3 Compound protects plastics, rubber, fabrics and metals. It's serviceable from —40 to 400 F.

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LET US HELP YOU FIND OUT

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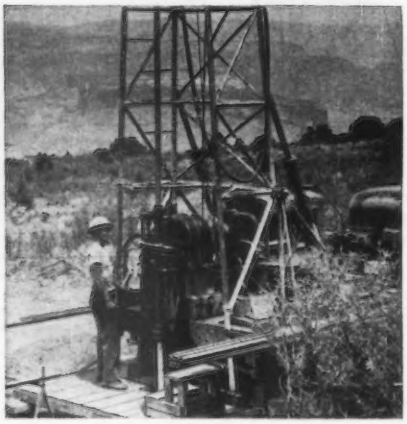

Coal in Kentucky . . . Uranium on the Colorado plateau . . . Bauxite in the Ozarks . . . Limestone in Pennsylvania . . . Copper in Montana . . . These are but a few examples of the extent of our operations. Throughout the United States and even in many foreign countries we have successfully explored and proved ore reserves for our many customers, and where normal methods have failed, special techniques have been developed. In the Gas Hills Area of Wyoming, for example, we successfully cored the loose sand and siltstone where others had failed by "freezing" the material. Our personnel and equipment are stationed throughout the United States awaiting your call.

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S&H SINCE 1853

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Austria *(Continued)*

Output of iron ore was down. A 2.5% drop brought a yield to 3,400,000 metric tons; a slight reduction in wolfram ore mining was also noted.

IN MALAYA

The Eastern Mining & Metals Co. (EMMCO) recently announced it will invest M$50-million to develop iron-ore deposits in the Bukit Ibam area of Malaya, 110 miles up the Rompin River on the east coast. (M$1 equals US$0.33). The deposits reportedly contain 17-million tons of iron ore, averaging 62% iron.

The Rompin mine, scheduled to begin production in 1962, will produce an average 2-million tons of iron ore annually.

Malaya's first full year of tin output restriction resulted in production in 1958 being the lowest for eleven years.

Federation mines, which as recently as 1956 had produced a post-war record of 62,295 tons of tin-in-concentrates, had their output cut last year to 38,458 tons.

This was a slash of 35% from 1957 and on Dec. 31 the number of active mines operating was down 43% for the year to 417.

In the 12 months there was a net closing of nearly 52% of the dredges, 44% of the gravel pumps and 23% of other mines.

The December production figures were generally a little better.

Output was up by nearly four per cent to 2,729 tons; there was also a rise of nearly 1% in the number employed to 23,153 and the number of active mines increased by 17 to 417.

But during the month seven dredges closed leaving 34 in operation. Four other mines also closed, making the total in this category 50.

Trunnions

(Continued from p 85)

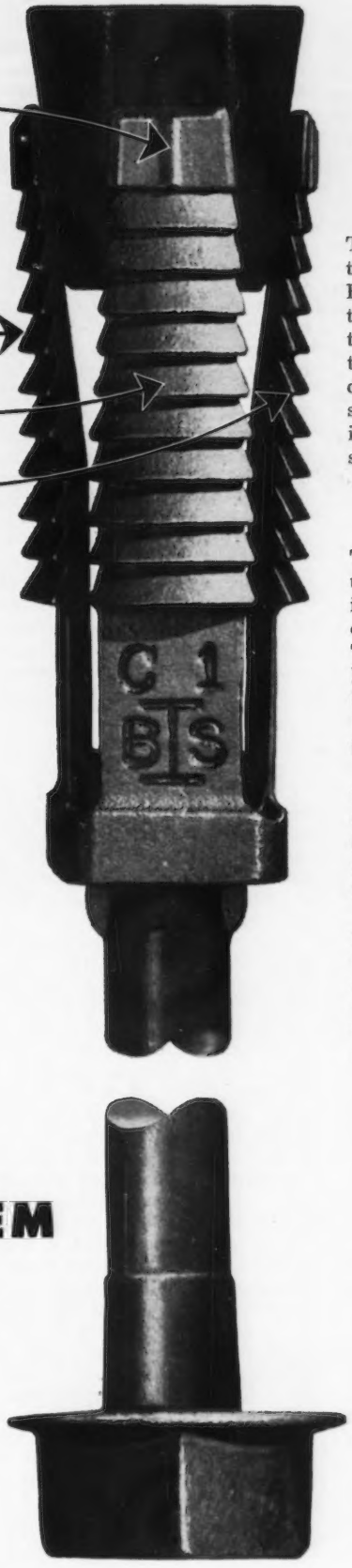
80 deg F. At depressed temperatures, oil may cling to the internal buckets, so that a substandard amount of lubricant is delivered.

4. Power expenditure in the system is small and more than compensated by the lower horsepower loss in each bearing. The lower power loss is due to heavier oil film and the minimizing of boundary lubrication at the relatively slow trunnion speeds.

5. Since the system is running continuously, it is unnecessary to insert elaborate interlocking and timing devices to assure adequate lubrication prior to and during running periods, as well as after the mill has been stopped.

(Continued on next page)

Here's where it takes hold



This is the expansion shell used on the end of a Bethlehem Headed Roof Bolt. Inserted in a hole drilled into the mine roof, the serrated leaves of the shell expand quickly when the tightening of the bolt draws the plug down on the threads. In a matter of seconds, the shell and bolt are locked in the hole, thus providing a firm, secure roof.

HEADED BOLT COMES IN 3 SIZES

The Bethlehem Headed Roof Bolt, used with the malleable-iron shell, is furnished in three diameters, each of which is made in varying lengths. The ¾-in. carbon bolt and the ⅝-in. high-strength bolt have a typical breaking load of 24,000 lb; and the ⅞-in. high-strength bolt has a typical breaking load of 45,000 lb.

We also manufacture a 1-in. slotted roof bolt, which is used with a steel wedge. Either bolt, headed or slotted, can be used with square plate washers, angle washers, or roof ties.

Why not include roof bolting as part of your safety program? If you will contact the nearest Bethlehem sales office, we'll arrange to have an experienced engineer discuss bolting techniques at your properties, and render assistance to bolting crews.

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BETHLEHEM STEEL

BETHLEHEM STEEL

Trunnions *(Continued)*

6. After the mill is stopped and it is contracting during the cooling-off period the system will keep the trunnions floated within the bearings to eliminate any distress which might result from the sliding of two dry surfaces.

7. Since the system is operated in conjunction with the internal bucket system, it can be stopped at any time for servicing without stopping the mill. If an internal self oiling system is not used, the interlock arrangement must be altered to stop the mill.

8. The system performs without being constantly checked and with a minimum of connecting piping. The three pressure switches (S1, S2, and S3 in Fig. 4) indicate when the filter requires change, that the bearing reservoir oil level is critically low, and that the suction line or high pressure line is ruptured, cut, or kinked.

The system can be used in conjunction with any mill bearing that has an oil reservoir. If the bearing oil reservoir is small, a five or ten gallon tank can be used as an intermediate reservoir. An optional interlock system is available which interlocks the pressure switches with the mill motor. Added protection is assured by preventing a mill start if filter requires change or if trouble occurs within the lubrication circuit.

The "Lubritrol" system was designed as a maintenance tool to protect bearings, to release men from small routine assignments, and yet to guarantee that those small but vital assignments are performed.

CMA

(Continued from p 104)

ably by applying them to "unmanufactured" items only, such as pig lead, slab zinc, and lead and zinc concentrates, while permitting unlimited quantities of manufactured commodities such as zinc oxide, lead oxide, die cast alloys, zinc sheets and lead sheets to enter the U.S. He made the point that very little manufacturing was required in the production of these quota-free products.

Following conversations at the U.N. lead-zinc sessions at Geneva in November, Schwab said that his committee had a feeling "that government officials (including Interior, Commerce and State) had a clearer picture and greater understanding of our side of the matter." Co-chairman, Ed Snyder interjected, "We're ultimately going to have the State Department represent the U.S. as far as the metals industry is concerned."

Potash for Centuries

"There is little doubt that mineable reserves of potash in Saskatchewan are enormous—*sufficient, no doubt, to supply the world's consumption for several centuries.*" These were the conclusions drawn by J. B. Cummings, administrative assistant in charge of exploration, Potash Company of America and Potash Company, Ltd., of Canada, who delivered a paper on "Potash in the United States and Canada." He referred to estimates of recoverable reserves at a depth not exceeding 3,500 ft made by E. Y. Crayson, of the Saskatchewan Department of Mineral Resources, totaling 6.4-billion short tons of K_2O equivalent. The estimate was based upon the recovery of a singular bed in each of three potash zones having an average thickness of 5 to 10 ft and a minimum K_2O content of 25%. Estimates assumed a 40% mining extraction and 90% milling recovery. With additional plants in operation in Canada, Cummings said that production capacity will be still further in excess of demand, and that some future curtailment of production in the Carlsbad area will be inevitable.

Tungsten Revival

"While tungsten producers have been through the proverbial wringer, we still have enough optimism to believe *we may be back in business this year,*" Raymond L. Sullivan, president of Minerals Engineering, told members of a tungsten session.

Noting that the number of domestic tungsten producers fell off sharply from 700 in 1955 to two today, Sullivan said that abnormally low prices had reduced Free World production to well below the consumption level. He estimated that a minimum of 1-million short ton units of WO. would be consumed in the Free World, half of which would be used by the U.S. "It is not anticipated that the general demand over this year will be the same each month, or that present stocks will be withheld and sold on a prorata basis. The events would be more in the nature of faster reduction from present stocks during the period of rising demand, to be followed by gradual rises in prices which would attract reopening or expansion of mines having lowest costs. The reopening stage is not anticipated until some time after midyear, or when prices for tungsten reach a minimum of $28 to $30 per short ton unit." The $28 to $30 price would reactivate about 20,000 units of domestic production, he said. The price would have to reach $35 before any additional production would be stimulated.

More than a Trillion Bbl

Much enthusiasm was whipped up over oil shale, partly because of Under Secretary of Interior, Elmer F. Bennett's statement, "Shale Oil may represent a great new mineral development for Colorado, comparable to or greater than Central City, or Leadville, or Climax or the great petroleum developments. We estimate that *there are more than a trillion barrels of oil* locked up in the Green River formation of Colorado, Utah and Wyoming, nine-tenths of it within the borders of Colorado. . . . Industry has become increasingly interested, and we believe that it is only a question of time until technological development will make this great natural resource the basis of a new and major industry."

These trillion barrels of oil are largely locked up in deep deposits not now economically possible to mine, according to Kenneth E. Stanfield, U.S. Bureau of Mines chemist of Laramie, Wyo., who discussed "Oil Yields of Green River Oil Shale of the Piceance Creek Basin of Northwest Colorado." He presented slides showing deeply buried oil-rich shales in this area.

Speaking of atomic blasts to mine oil shale, Dr. Roland S. Herbst, Lawrence Radiation Laboratory, Livermore, Calif., said "Even if we had the green light right now for setting up the test, the shot couldn't be fired before the spring of 1960." As now discussed, Herbst said that the shot would entail the explosion of a 10-kiloton atomic device at 1,000 ft underground in the Piceance Creek oil shale deposits in Northwestern Colorado, possibly on the land of the U.S. Naval Reserve.

PERSONALS

L. Telfer has become manager of exploration and **G. N. Moore** is the new general superintendent of exploration for the Consolidated Mining & Smelting Co. of Canada Ltd. In addition, **B. E. Hurdle** has been appointed manager of mines.

Telfer

New appointments were also made in Cominco's engineering division. **J. W. McKay** has become chief mechanical engineer and **W. G. Small** has been named chief instrument engineer.

Yes! . . . it's ALL STEEL

HP RANGE:
½ to 50 hp

RATIOS:
4:1—14:1—24:1 (or 20:1)

OUTPUT SPEED RANGE:
420 to 5 rpm

TORQUE RATINGS:
up to 41,000 lb-in
(Consult factory for higher torque capacity)

FALK ALL STEEL Shaft Mounted Drive

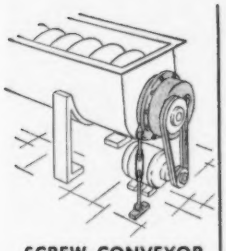
. . . Steel can "take it"!

STEEL frame . . . of fabricated plate supports all rotating elements—provides double the ability of iron to maintain vital alignment of revolving elements, even under shock load or external impact.

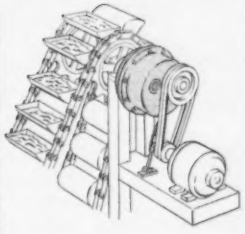
STEEL housing . . . will not fracture, serves only as protective cover and lubricant reservoir. Therefore, lubricant supply is safeguarded.

STEEL tie-rod and straddle-mounted tie rod brackets . . . are fastened to heavy steel frame by steel bolts in double shear.

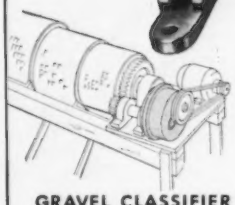
A FEW TYPICAL APPLICATIONS



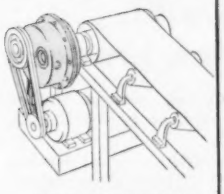
SCREW CONVEYOR



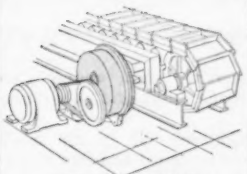
BUCKET ELEVATOR



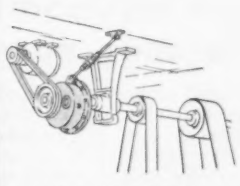
GRAVEL CLASSIFIER



BELT CONVEYOR



APRON FEEDER



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FALK

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Personals *(Continued)*

John B. Knaebel has been appointed president and managing director of Anaconda Iron Ore (Ontario) Ltd., subsidiary of the Anaconda Co. (Canada) Ltd., according to **Clyde E. Weed,** Anaconda Co. board chairman.

Knaebel

Mr. Knaebel, a mining engineer and geologist, has been associated with Anaconda since 1946, and has headed many of its exploration projects in the western hemisphere. He is credited with the discovery of the Jackpile uranium mine near Grants, N.M.

Chester H. Steele, vice president of western operations, Anaconda Co., Butte, Montana, has been named chairman of the program committee for the 1959 Metal Mining & Industrial Minerals Convention of the American Mining Congress, which will be held in Denver on September 14-17. The announcement of Steele's appointment was made by **Raymond E. Salvati,** president, Island Creek Coal Co., Huntington, West Virginia, president of the AMC, and **Chris Dobbins,** president, Ideal Cement Co., Denver, chairman of the AMC's western division.

Houston N. Clark has been promoted to the position of assistant to the president of the Potash Co. of America. For the past two years, Clark was general superintendent of the company's Dumas and Carlsbad operations.

Raymond R. Knill has become the firm's general superintendent and **David Rice** will take on the job of mine superintendent at the Carlsbad operation.

Joseph Pursglove, Jr., vice president of research and development of Consolidated Coal Co., Pittsburgh, Pa., was recently elected a member of St. Joseph Lead Co.'s board of trustees. **James G. Colvin,** former St. Joe comptroller and assistant treasurer has been elected treasurer of the company. **William L. Murphy, Jr.,** formerly assistant comptroller, became comptroller.

John C. MacDonald, manager of the Henderson operations of U.S. Lime Products Div., Flintkote Co., was named president of the Nevada Mining Association Inc., at the annual meeting held in Reno on January 10. Other newly elected officers are **John C. Kinnear Jr.,** Kennecott Copper Co., first vice president; **Louis D. Gordon,** executive secretary, and **John C. Kinnear,** honorary president. Directors in addition to the officers are **Henry C. Curtis,** American Potash & Chemical Corp., **Robert O. Jones,** Standard Slag Co., **William L. Kendrick,** Manganese Inc., **A. E. Millar,** Anaconda Co., **H. P. Willard,** Basic, Inc., and **S. H. Williston,** Cordero Mining Co.

Harry J. Wolf, mining consultant, is examining properties in South America.

Earl T. Hayes has been named chief metallurgist, U.S. Bureau of Mines, succeeding the retired **Oliver C. Ralston.**

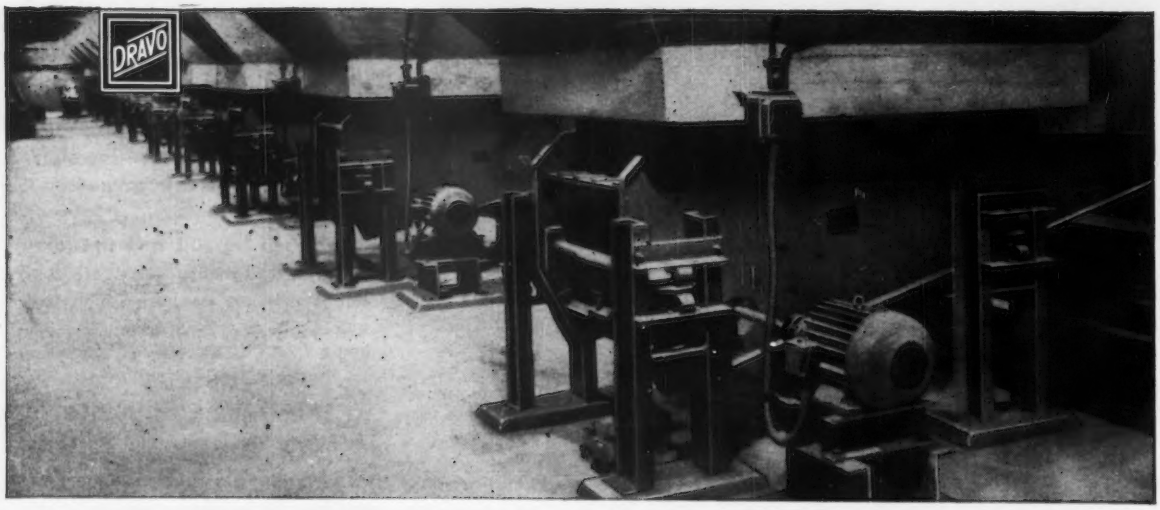
George F. Weaton Jr. has been appointed director of ore reserve estimates for the University of Minnesota's School of Mines and Metallurgy.

Arnold Hoffman's book, *Free Gold,* is being issued after having been out of print for several years. Mr. Hoffman is president of Mesabi Iron Co. and Quebec & Exploration Ltd.

Fraser W. Bruce has been elected to the board of directors of Aluminium Ltd. He is president of the company's principal subsidiary, Aluminum Co. of Canada, Ltd.

The Hon. J. Kenneth Weir, C.B.E., chairman of G. & J. Weir Holdings Ltd. and G. & J. Weir, Ltd., Glasgow, Scotland, has been elected a director of the International Nickel Co. of Canada, Ltd., and a member of its advisory committee, according to a recent announcement by **John F. Thompson,** president, and **Henry S. Wingate,** board chairman of International Nickel.

Weir



Low maintenance, economical operation with DRAVO-SCHENCK vibrating screens, conveyors, feeders

Low maintenance is the keynote of Dravo-Schenck equipment. In typical installations like the row of feeders shown here, repair and replacement is held to a minimum.

The reason for such economical operation is found in the precision design of the unique "Micro-Thrust" exciter unit which reduces wear by moving material with minimum contact with troughs or screens, and the rugged construction of all wearing parts.

These heavy duty screens, conveyors and feeders are at work in a wide variety of applications—handling ferrous and non-ferrous ores, sinter, chemicals, cement clinker, crushed stone, coal and other abrasive or hard-to-handle materials.

Our engineers will gladly work with you on specific problems or write for Bulletin No. 1475, Dravo Corporation, Pittsburgh 25, Penna.

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AT HOME ON THE "RANGE"

If there's an 8-yard mining shovel in your future, make it a Marion 181-M.

Here's a husky machine with the traditional strength, power and endurance of Marion mining shovels—plus small machine cycle time for an extra payoff every day.

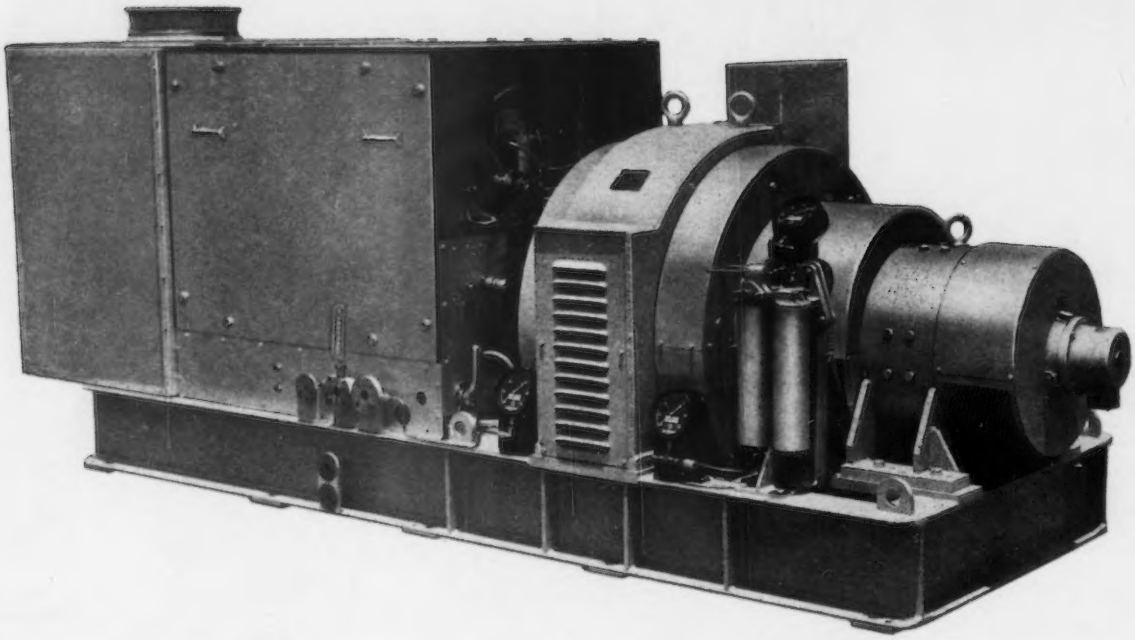
The 181-M has a combination of design, construction and performance features that can lower your costs and add to your profits.

If you haven't seen Bulletin 439 on this 8-yard Marion, write for your copy today.

You get **MORE** *with* **MARION**

MARION POWER SHOVEL COMPANY • **Marion, Ohio**

A Division of Universal Marion Corporation

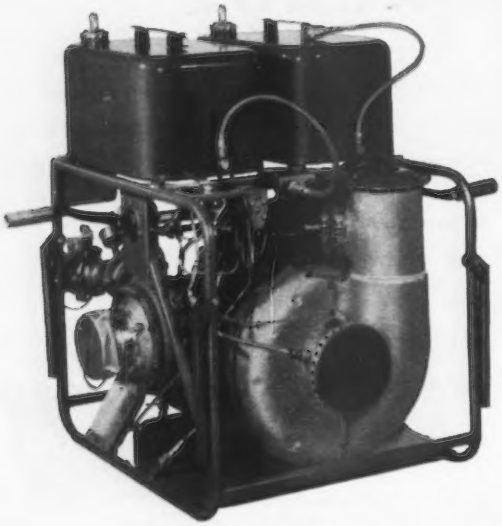


Portable Solar gas turbines offer greater, more reliable power for on-site operation

Portable Solar generators can be easily moved to remote locations.

Solar's 100 lb pump can be started by hand, delivers 500 gallons per min.

PORTABLE, PROVEN IN SERVICE Solar gas turbines provide rugged, dependable power for on-site operation. Simple in design, with few moving parts, they require a minimum of maintenance and no operating attendance. And they can be operated on almost any available fuel including gasoline, kerosene, diesel fuel, jet fuels and natural or manufactured gas. For generating electricity, driving water and process pumps, and for air and gas compressor drive—*for any use where portability, dependability and greater power are important*—investigate the Solar family of gas turbines.



POWERED BY a 500 hp Jupiter® gas turbine, Solar's 300-kw generator (above) weighs only 6900 lb and is considerably smaller than the average automobile. Solar's 50 hp Mars® gas turbine-powered pump (left) delivers 500 gallons of water per minute—as much as a good-sized fire engine—yet can be carried easily by two men. For more information about these and other Solar gas turbines, write to Dept. F-131, Solar Aircraft Company, San Diego 12, California.

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ENGINEERS WANTED: Challenging projects, unlimited opportunities, good living with Solar. Write today!

(The) Standard of Comparison for HARDNESS AND TOUGHNESS

In performance tests by company after company, Sheffield Moly-Cop balls are used as the quality standard by which grinding balls of every make are measured. A big reason is the perfect balance of Moly-Cop hardness and toughness—unvarying to the core. This means a longer grind, fewer chargings, less down-time, and other production economies for you.

New steels are born at Armco

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UNDISTURBED SAMPLES
FROM DIFFICULT FORMATIONS

ACKER-DENISON CORE BARRELS

THE ACKER-DENISON CORE BARREL PERFORMS WHERE OTHERS FAIL

The ability of the Acker-Denison Core Barrel to obtain undisturbed top quality cores from rare earths, ceramic clays, soft, but difficult formations accounts for its worldwide acceptance by mining and soils engineers.

ACKER-DENISON CORE BARREL —PROVED AND IMPROVED

While the basic features of the original Denison are duplicated in the samplers manufactured by Acker, numerous improvements suggested by Acker's 40 years of soil sampling experience are incorporated in the new Acker-Denison. It is these improvements that make the Acker-Denison even more useful and efficient than before!

Remember, no other manufacturer can offer the improved performance and exclusive patented features of Acker's new Denison Core Barrel. This proud achievement of Acker development and progress is exclusively Acker!

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"After a couple of years I'm still amazed at the Caterpillar Oil Clutch. It stays in adjustment longer than other clutches stay together. It's a real top performer."

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Personals *(Continued)*

Richard C. Cole, vice president of Vitro Uranium Corp., has been named president of this division of Vitro Corporation of America at Salt Lake City.

Cole succeeds **W. B. Hall,** also of Salt Lake City, recently named a vice president of Vitro Corp. and head of that firm's chemical metallurgical and uranium production and processing.

Neill K. Banks and **Harold E. Christensen** have been elected vice presidents of Texas-Zinc Minerals Corp., jointly owned by the Texas Co. and the New Jersey Zinc Co.

Christensen

Banks

Mr. Banks had been serving as general manager of Texas-Zinc Co.'s smelter at Depue, Ill.

Mr. Christensen served as a geologist in the domestic producing department at various locations and, in 1942, became division geologist at Denver. In 1953 he was appointed assistant division manager of the department's office there, the position he held at the time of his promotion.

Floyd R. Anderson, administrative assistant of the Denver division of Gardner-Denver Co., has been named the firm's chief metallurgist.

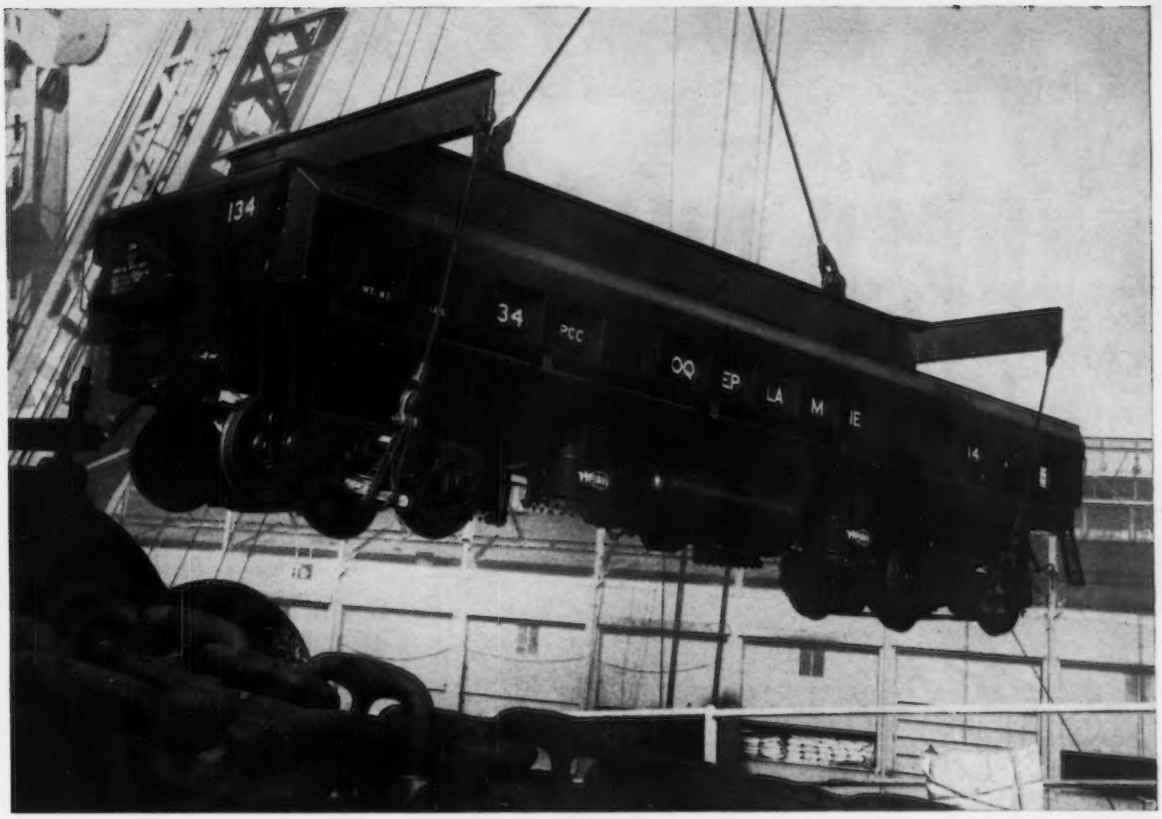
D. M. McDowell has been made director of engineering for the Roots-Connersville Blower Div., Dresser Industries, Inc.

Carl B. Jacobs, Glenville, Ill., general manager of raw materials for Inland Steel Co., and a vice president and director of Pacific Isle Mining Co., has been appointed Inland's vice president in charge of raw materials. He succeeds **Philip D. Block, Jr.** who has become vice chairman of the company.

John T. Nolan, chief mining engineer for the Oliver Iron Mining Div.'s eastern district, retired on January 1. He had been with the Oliver for 40 years. Nolan has been succeeded by **Bruno Scirioni** who has been with the company since 1949 and became assistant chief mining engineer in 1956.

Dr. H. Richard Gault will become the new head of the department of geology at Lehigh University on July 1. He will succeed **Dr. Bradford Willard** who retires at the end of June. Dr. Willard has been chairman of the department since 1939.

L. J. Molinaro has been appointed superintendent of the mechanical maintenance department of the Silver Bay Div. of Reserve Mining Co. Molinaro has been assistant superintendent since 1955.



Being hoisted aboard a ship bound for Peru is one of 85 new Western dump cars slated for use at the new Toquepala copper mining project.

For Southern Peru Copper . . .
85 built-to-take-a-beating Western dump cars

Cars that transport copper ore from the open-pit mine to the concentrator at the mammoth new Toquepala project in Peru, about 55 miles from Ilo, have to be rugged. Loads of this heavy, dense material call for cars that can stand up under steady battering. That is one of the big reasons why Southern Peru Copper Corporation of New York chose Westerns.

The cars ordered were specially built of heavy-gauge, double-reinforced steel. Weighing 87,000 lb. and measuring approximately 43 ft. by 11 ft., they have a level full capacity of 43 cu. yd., or 90 tons.

Western dump cars also embody these features that have made their name synonymous with profitable operation:

- Door control mechanism, located at ends of car—substantial, fully enclosed, foolproof
- Exclusive dual side-pivots, permitting dumping with least effort and air consumption
- Fast-acting dumping mechanism and steep dumping angle to speed up operation, cut costs
- Automatic cut-off valve for smooth dumping
- Body underframe of one all-welded unit heavily reinforced throughout to prolong car life
- Double-plate, curved-top door, strongest made
- Low center of gravity to assure stability in all situations

Built by B-L-H's Eddystone Division, Western dump cars are available in any size up to 60 cu. yd., any capacity up to 100 tons. Write us for complete information.

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Personals *(Continued)*

Kennedy Ellsworth has become a director of Desert Minerals, Inc., and its affiliate, American Mineral Co. The appointment was made by **E. J. Ellsworth,** president of Desert, and **Blair Stewart,** president of American Mineral.

Carroll P. Donohoe has been elected president and general manager of the Cananea Consolidated Copper Co., S.A., a 99%-owned subsidiary of the Anaconda Co. Donohoe, who began his career with the firm as a chemist at Anaconda, Montana, in 1925, succeeds **Albert Mendelsohn,** who has retired.

Donohoe

Cananea also announced that **Robert C. Weed,** formerly general superintendent, has been named vice president and assistant general manager. **George E. Morris** has been given the post of general superintendent.

Milton Steinheimer, geologist and assistant works manager of the Eagle-Picher plant at Clark's Station, has been named the new president of the Reno subsection of AIME. Other new officers are **Kenneth Jones,** geologist for the Anaconda Co., vice president; and **Prof. Jack Winston,** Mackay School of Mines, secretary and treasurer.

James P. Blaisdell, formerly with the Pineapple Cos. of Hawaii, has been named assistant to the president of the Bunker Hill Co. in Idaho.

J. A. Mecia has been elected a general vice president of Utah Construction Co., according to a recent announcement by **Marriner S. Eccles,** chairman of the board.

Ray W. Anderson has been appointed superintendent of the mechanical maintenance department, Babbitt Div., Reserve Mining Co.

Fred Burnett, Garrison, Montana, was elected president of the Mining Association of Montana on January 14. He is vice president of the Montana Phosphate Products Co. Mr. Burnett succeeds **John Bley,** vice president of the American Chrome Co., Nye, who became chairman of the group's executive committee.

Walter J. Williams, Cleveland, manager of construction and development for Pickands, Mather & Co., has been named president of Manganese Chemical Corp. of Minnesota (P.M.&Co.) to replace the retired **Francis P. Brown.**

Dr. Lloyd G. Mount joined the staff of Vitro Laboratories, West Orange, N.J., as head of the chemical research and development department. Before joining Vitro, Dr. Mount was associated with American Cyanamid Co., Chemstrand Corp., and the Food Machinery & Chemical Corp.

This dipper sees its dentist just twice a year

Because its teeth are two-part Amsco® "Simplex". Once, another brand of teeth was used on this 3-yard Amsco welded dipper at Vigus Quarries Inc., in Robertson, Mo. The constant smashing (9-hour, 5-day week) into jagged limestone material wore them into replacement in 6 to 8 weeks. The first set of standard design Amsco Simplex teeth was in service from May 20, 1958 through October 31, 1958 —*twenty-four weeks!*

Says Fred Weber, Jr., vice president of Vigus Quarries Inc., "The Simplex record speaks for itself . . . 3 to 4 times longer service. Now we've got Simplex points on all three of our machines and the saving is considerable."

Amsco Simplex's special alloy reversible tips are the answer to your dipper's high "dentist" bills. We'll be glad to send you a booklet containing reports by Simplex users and describing Simplex teeth completely. Write for it today.

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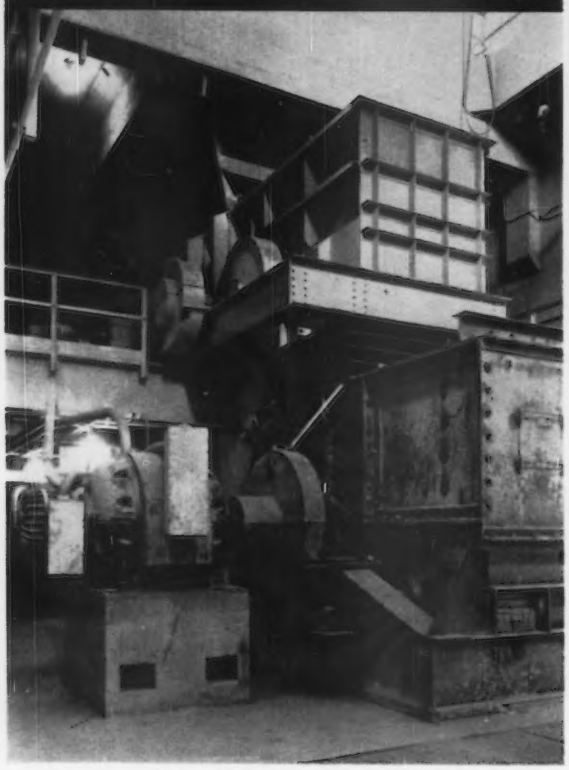
Another size reduction problem solved by Hammermills, Inc.



Non-Clog Bulldog Hammermill

Crushes 400 T.P.H. from 42" to 1" and under

This non-clog BULLDOG HAMMERMILL takes feed ore 42" and under containing 22% moisture, 13-15% silica. It reduces this material to a fineness of 1" and under at a rate of 400 tons per hour using only 400 h.p. Over the past 5½ years, the Bulldog Hammermill crushed an average of 166,500 tons between hammer resurfacings. Maintenance costs were only .0014 per ton.

Hammermills, Inc. can help you reduce the cost of your end product. For the name of the Hammermills' representative in New York, Chicago, St. Louis, Toledo, Dallas, Denver, Los Angeles and Melbourne, Florida, write us.

Manufacturers of: Hammermills for Primary and Secondary Crushing • Impactors • Jaw Crushers • Roll Crushers • Cone Crushers • Wobbler Feeders • Apron Feeders

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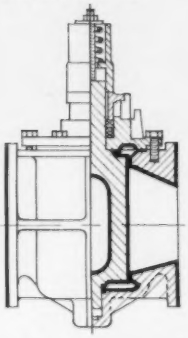
26% Uranium ore in a 1% Sulphuric acid solution

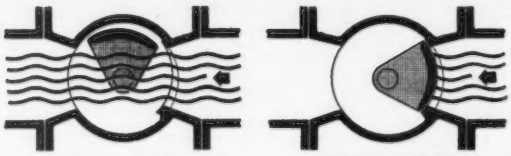
Put that in your pipe and valve it!

And *that's* the process problem that was solved with the installation of iron-bodied, soft-rubber-lined DeZurik Valves with an Alloy 20 rubber-covered plug.

It's not surprising to find DeZurik Valves on the roughest services. Whether they're specified first . . . or the last to be tried . . . they stay on and on and on!



All surfaces in the flow pattern can be soft rubber lined in a DeZurik Valve, offering *complete* protection from abrasive or erosive services. There are no internal cavities where slurry material can pack.



With DeZurik's *exclusive* Eccentric Action, the plug does not *slide* against the seat. DeZurik Valves *always* close easily—regardless of the pressure inside the valve!

When corrosion or abrasion—or both—threaten your process lines . . . remember: DeZurik Plug Valves last longer and are usually *less* expensive in the first place!

Representatives in all principal cities, or write for more details.

DeZURIK CORPORATION

SARTELL, MINNESOTA.

Four reasons why this NI-HARD cast drop ball is a smash hit!

This Ni-Hard* cast iron drop ball is dedicated to a long life "on the rocks." Its service record – and that of other GIW Ni-Hard drop balls produced by the Special Products Division of Georgia Iron Works, Augusta, Ga.– has proved to be *four* times longer than that of any other type ball. In fact, most GIW Ni-Hard balls have replaced forged steel balls. Here are four reasons why:

• **Design.** Notice the design of the ball. It has been quoted to be so well balanced that the operator is able to lift and drop the ball more times per shift. One operator stated that his overtime was eliminated when he started using Ni-Hard balls.

• **Abrasion resistance.** Ni-Hard is one of the hardest commercial products of the iron foundry, possessing outstanding abrasion resistance. This important property enables Ni-Hard balls to withstand the severest wear of the hardest rocks.

• **Strength and toughness.** In addition to abrasion resistance Ni-Hard drop balls are tough enough and strong enough to withstand impact in this most demanding operation. They resist breaking or chipping.

• **Economy.** Only a Ni-Hard *cast* drop ball could be economically produced to take advantage of the money-saving features mentioned above. And, of course, the long service life of Ni-Hard drop balls means greater operating economy.

Put these Ni-Hard advantages to work for you. Next time you buy drop balls, get in touch with a Ni-Hard producer. There's one near you. If you don't have his name, write Inco for a list of authorized Ni-Hard producers.

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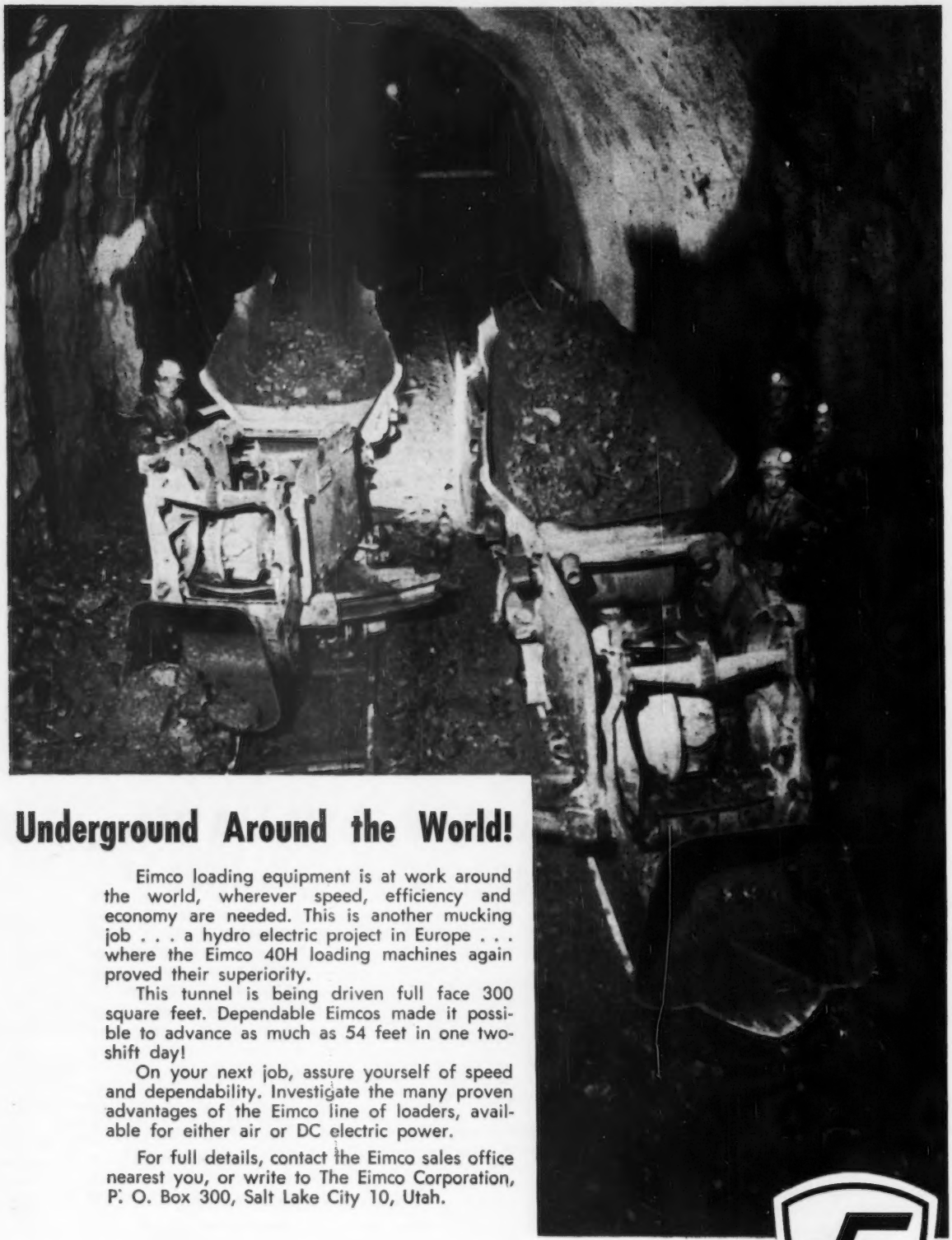

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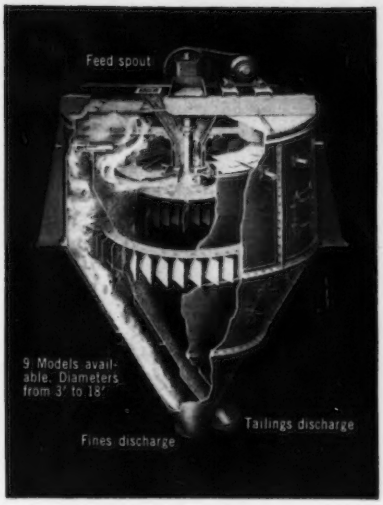

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Personals *(Continued)*

E. M. Furness, superintendent of Reserve Mining Co.'s crushing and concentration department, has been named to the newly created position of assistant executive vice-president of the company, according to **Robert J. Linney,** executive vice president.

Dunbar

Rood

Alfred D. Rood, formerly in Anaconda's mining department, has been named assistant to the vice president of Andes Copper Mining Co. and Chile Exploration Co. Rood succeeds **Douglas M. Dunbar** who has retired.

Samuel K. Scovil has been appointed manager of ore sales department for the Cleveland Cliffs Iron Co. He came to the company in 1950 from Republic Steel Corp., and, in 1952, became assistant manager of sales.

John L. McGara, president of Yuba Consolidated Industries, Inc., recently announced that the company had organized a new division — Yuba Consolidated Erectors, Inc. The division will perform all field erection work for Yuba's heavy steel fabricating divisions.

Erectors' president will be **J. Philip Murphy;** vice president and general manager, **Francis J. Murphy.** These men have worked together to erect such steel structures as the world's highest arch bridge over Colorado River's Glen Canyon (700 ft), Richmond-San Raphael bridge; interstate bridge at Portland, Oregon; 120-in. telescope atop Mt. Hamilton; Atlas ICBM test stands; giant gantry cranes for McNary Dam, Washington; and many others.

Edward McLanahan Tittmann has been elected a vice president and director of American Smelting & Refining Co., according to **J. D. MacKenzie,** chairman of the board. He will be in charge of Asarco's smelting and refining operations.

Robert R. Portmass, former industrial engineer on staff of western mining divisions, Kennecott Copper Corp., has been named to the newly-created post of industrial engineer at the Garfield smelter, Utah Copper Div.

F. P. Brown, Cleveland, manager of ore sales for Pickands, Mather & Co., has retired. Mr. Brown had been with the company for 35 years and assumed his latest position ten years ago. He has been succeeded in this position by **Robert S. Carey** who has been with P. M. & Co. since 1938.

Philip D. Pearson, manager of Inland Steel Company's Caland Ore Co., Ltd. at Atikokan, Ontario, has been made

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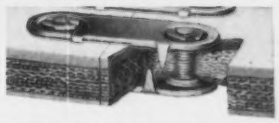

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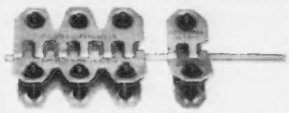

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Personals *(Continued)*

manager of iron ore mines for Inland. He succeeds **Howard M. Graff** who has been promoted to general manager of Inland's raw materials department in Chicago. **Peter P. Ribotto,** chief engineer of iron ore mines, succeeds Mr. Pearson as manager of Caland Ore Co., Ltd. **Douglas E. Brown,** senior engineer at the company's Sherwood mine in Iron River, Michigan, becomes chief engineer of iron ore mines. Mr. Pearson and Mr. Brown will move to Ishpeming, Michigan, where the company's head mining office is located.

George F. Weaton, Jr. has been appointed Director of Ore Reserve Estimates for the Minnesota department of taxation. **Dr. D. H. Yardley,** associate professor of mining at the Univ. of Minn. School of Mines, who had previously supervised this work, asked to be relieved in order to devote his full time to teaching. Mr. Weaton had been full time ore estimation engineer working under Dr. Yardley.

Joseph R. Gross, Calumet, has been appointed general mine foreman at Jones & Laughlin's Hill Annex mine. Mr. Gross, a graduate mining engineer, began with J. & L. in 1951.

James A. Reynolds has been promoted to superintendent of the crushing and concentrating department for Reserve Mining Co.

OBITUARIES

Joseph E. Kennedy, 95, founder and board chairman of Kennedy Van Saun Mfg. & Eng. Corp., died January 9 at his home in New York.

In 1907, Mr. Kennedy started his own business in New York City and, in 1916, he bought the Old Danville Iron & Steel plant in Danville, Pa. At that time, the layout consisted of four buildings on 1½ acres. Today the plant is housed in 36 buildings and covers more than 16 acres of floor space.

Mr. Kennedy had more than 1,000 patents to his name.

Joseph van der Gracht, 78-year-old geologist, died January 11 in Vancouver. He was active in the mining industry in B.C. for many years before his retirement 10 years ago. He also worked with his late brother, Willem, in Lower California and in the Oklahoma oil fields.

G. H. (Tom) Lloyd, widely known in the mining industry and a past president of the Engineers' Club of Toronto, died February 10.

During student years at Queen's University, Lloyd worked in geological and railway location surveys, and later gained experience in mining engineering at Cobalt, Porcupine and Sudbury. For a time, he was engineer at the Jupiter mine, now part of McIntyre, and later served as mill superintendent at Long Lake Mines, south of Sudbury.

Ernest Albert (E. A.) Hodges, 84, for 20 years Utah State mine inspector (1919-1939) and later an employee of Combined Metals Reduction Co., Feb. 6. He retired from CMR in 1950.

John Sloan Stewart, 325 E. 72 Street, New York, consulting metallurgical engineer, died Oct. 14, 1958. He was 69 years old.

Mr. Stewart, a graduate of the Missouri School of Mines, and a long-time member of AIME, started his career with the American Smelting & Refining Co. However, much of his work was overseas: Russia, England, Canada, the Belgian Congo, and in the design and operation of the Trepca lead smelter and refinery in Yugoslavia.

In 1945, he developed the Stewart inverted-bosh blast furnace, had registered two patents, and was doing creative work at the time of his death.

Surviving are his widow, a son, Dr. John Sloan Stewart, and three grandchildren.

Hubert Raymond Banks, 67, former senior metallurgist for the Consolidated Mining & Smelting Co., died on February 4 at Ottawa.

Mr. Banks was closely associated with flotation process applications, and was instrumental in developing the first and only tin recovery in Canada.

Leo S. Hayes, Asarco engineer, died of a heart attack at his Tucson home on Jan. 31.

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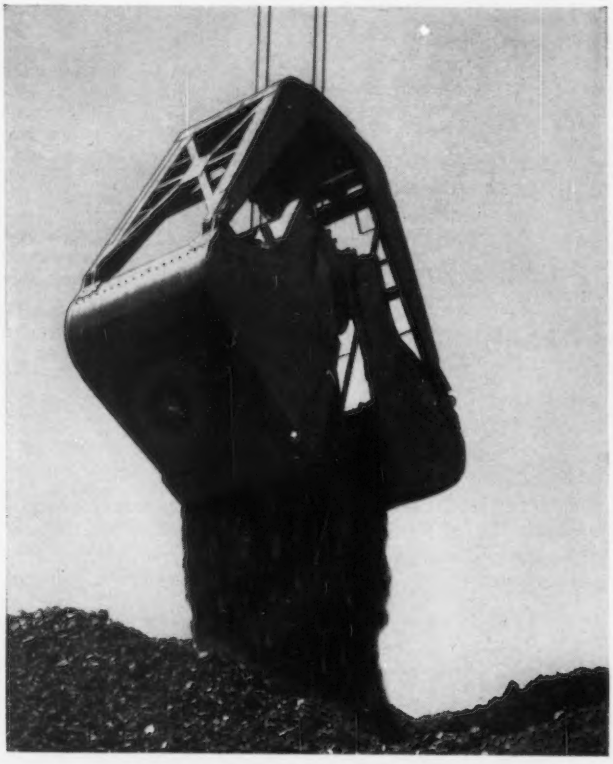

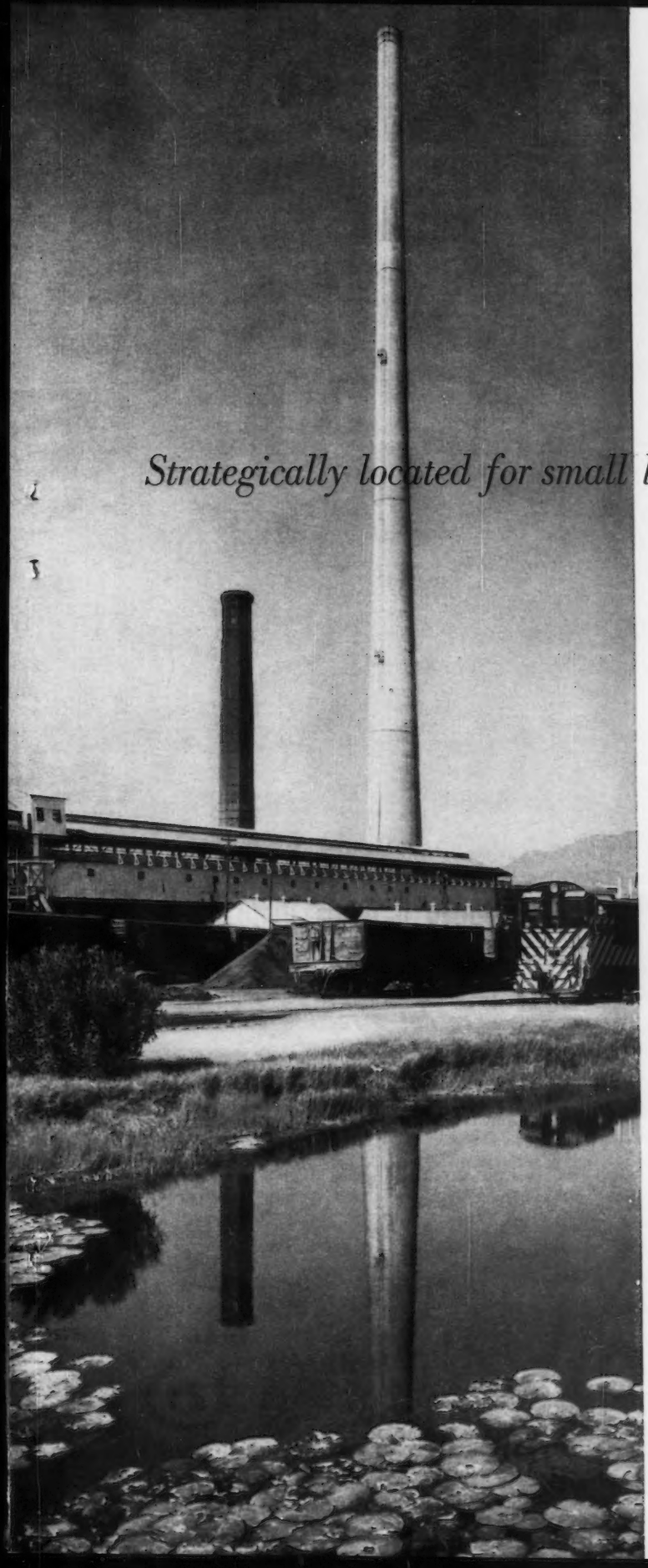

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or write to main office.
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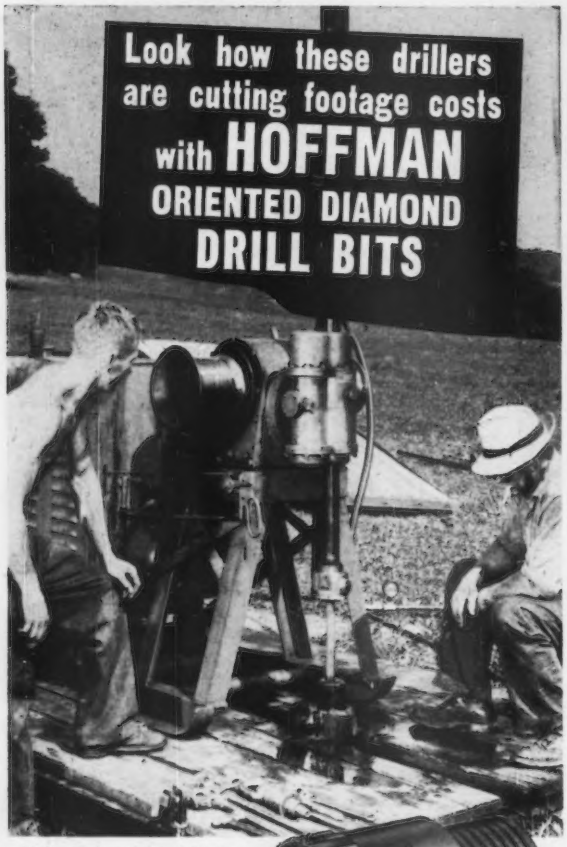

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1—15-HP Vulcan
1—20-HP H&B
1—25-HP Vulcan #1½
1—30-HP Vulcan #22C
2—40-HP Vulcan
1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
1—100-HP W. A. Box
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1—6' 5 disc Morse

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***Indicates more product information may be found in company advertising appearing in E&MJ 1958 Mid-June Mining Guidebook and Buying Directory Issue. Check your Guidebook Index.**

Acker Drill Co. 168
*Ainsworth & Sons, Inc., Wm. 134
Alemite Div., Stewart-Warner Corp. 133
*Allen-Sherman-Hoff Pump Co. ... Second Cover
Allis-Chalmers Mfg. Co. 47, 49, 51, 53
Allis-Chalmers Construction Machinery Div. 76-77
*American Cyanamid Co. 72
American Manganese Steel Div., American Brake Shoe Co. 171
*American Mine Door Co. 130
*American Smelting & Refining Co. 177
American Steel Foundries 39
*Anaconda Wire & Cable Co. 56-57
Atlas Copco 135

Barber-Greene Co. 128
Bethlehem Steel Co. 123, 161
Blaw-Knox Co., Equipment Div. 143, 176
Booth Co., Inc. 152
*Brunner & Lay, Inc. 146

Caterpillar Tractor Co. 5, 36-37, 168
Chevrolet Div. of General Motors 136-137
*Christensen Diamond Products 28
Clark Equipment Co. 151
*Colorado Fuel & Iron Corp. 58-59
Continental Gin Co. 158
Curtiss-Wright Corp., South Bend Div. 12

DeZurik Corp. 172
Deere Co., John 67
Deister Machine Co. 170
*Denver Equipment Co. 109
Detroit Diesel Engine Div. of General Motors 32-33
*Diamond Drill Contracting Co. 152
Dorr-Oliver, Inc. 8-9
Dow Corning Corp. 160
Dravo Corp. 164

Eddystone Div., Baldwin-Lima-Hamilton 169
*Eimco Corp. 174
Euclid Div., General Motors 157

Fairbanks, Morse & Co. 129
*Falk Corp. 163
Firestone Tire & Rubber Co. 50
Flexible Steel Lacing Co. 175
Ford Motor Co., Truck Div. 74-75

Gallagher Co. 124
General American Transportation Corp. 179
General Tire & Rubber Co. 125
Georgia Iron Works Co. 26
*Goodrich Aviation Products, B. F., A Div. of B. F. Goodrich Co. 112
Goodrich Industrial Products Co., B. F. 3
Goodrich Tire Co., B. F., A Div. of B. F. Goodrich Co. 119
Goodyear Tire & Rubber Co. 11
Gould-National Batteries, Inc. 34

Hammermills, Inc. 172
*Hardinge Co. 142
Hendrick Mfg. Co. 38
*Hercules Powder Co. 153
*Hewitt-Robins 48
*Hoffman Bros. Drilling Co. 178
Hough Co., Frank G. 60-61

Infilco, Inc. 158

*Ingersoll-Rand 1
Industrial Brownhoist Corp. 115
International Nickel Co. 173

Jenkins Bros. 105
*Joy Mfg. Co. 52, 107, 156

Kaiser Engineers 35
Kennedy-VanSaun Mfg. & Engrg. Corp. 155
Koehring Co. 68-69

LeRoi Div. of Westinghouse Air Brake Co. 64
*LeTourneau-Westinghouse Co. 27, 29, 31
Linatex Corp. of America 134
*Link-Belt Co. 139
Louisville Dryer Div. of General American Transportation Corp. 179

*Mack Trucks, Inc. 54-55
Marion Power Shovel Co. 165
*Mayo Tunnel & Mine Equipment Co. 178
McNally Pittsburg Mfg. Co. 121
*Mine & Smelter Supply Co. 73
*Mine Safety Appliances Co. 10
Minneapolis-Honeywell 62

National Filter Media Corp. 132
*National Malleable & Steel Castings Co. 111
*Naylor Pipe Co. 159
New York Engineering Co. 170
*Nordberg Mfg. Co. 117
Northwest Engineering Co. 13

Ohio Brass Co. 25
Okonite Co. 66

Porter Company, Inc., H. K., Refractories Div. 14

Republic Steel Corp. 144-145
Roebling's Sons Corp., John A. 15
Roots-Connersville Blower Div., of Dresser Industries, Inc. 65

Sanford-Day Iron Works, Inc. 6-7
Searchlight Section 181-185
Sheffield Div., Armco Steel Corp. 167
Sly Mfg. Co., W. W. 120
Smit & Sons Inc., J. K. 140
Smith Engineering Works 71
Solar Aircraft Co. 166
Spang & Co. 126
*Sprague & Henwood, Inc. 160
*Standard Oil Co. of California 16
Standard Steel Corp. 147
*Stearns-Roger Mfg. Co. 70
Stenberg Mfg. Corp. 148
Stephens-Adamson Mfg. Co. 40
Sturtevant Mill Co. 175

Tennessee Corp. 170
*Texas Co. 63
Texas Gulf Sulphur Co. 30
Timken Roller Bearing Co. ..... Fourth Cover
*Traylor Engrg. & Mfg. Co. 149

United States Rubber Co., Mechanical Goods Div. 103
*United States Steel Co. 141

Van Gorp Mfg., Inc. 134

West End Chemical Co. 127
*Western Machinery Co. 131
*Western Rock Bit Mfg. Co. 122
Wheel Trueing Tool Co. ..... Third Cover
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp. 58-59
*Wilfley & Sons, A. R. 78

•

PROFESSIONAL SERVICES 181
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

•

EMPLOYMENT OPPORTUNITIES ... 182

BUSINESS OPPORTUNITIES 182

NOTICES
Auction 183

PROPERTY
For Sale 182

EQUIPMENT
(Used or Surplus New)
For Sale 182-185

WANTED
Equipment 182

ADVERTISING SALES STAFF

Atlanta 3 ..... M. H. Miller, 1301 Rhodes-Haverty Bldg., Jackson 3-6951
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New York 36 .. H. C. Chollson, R. W. Peckham, 500 5th Ave., Oxford 5-5959
Pittsburgh 22 .. .. Wm. H. H. Ginder, 1111 Oliver Bldg., Atlanta 1-4705
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